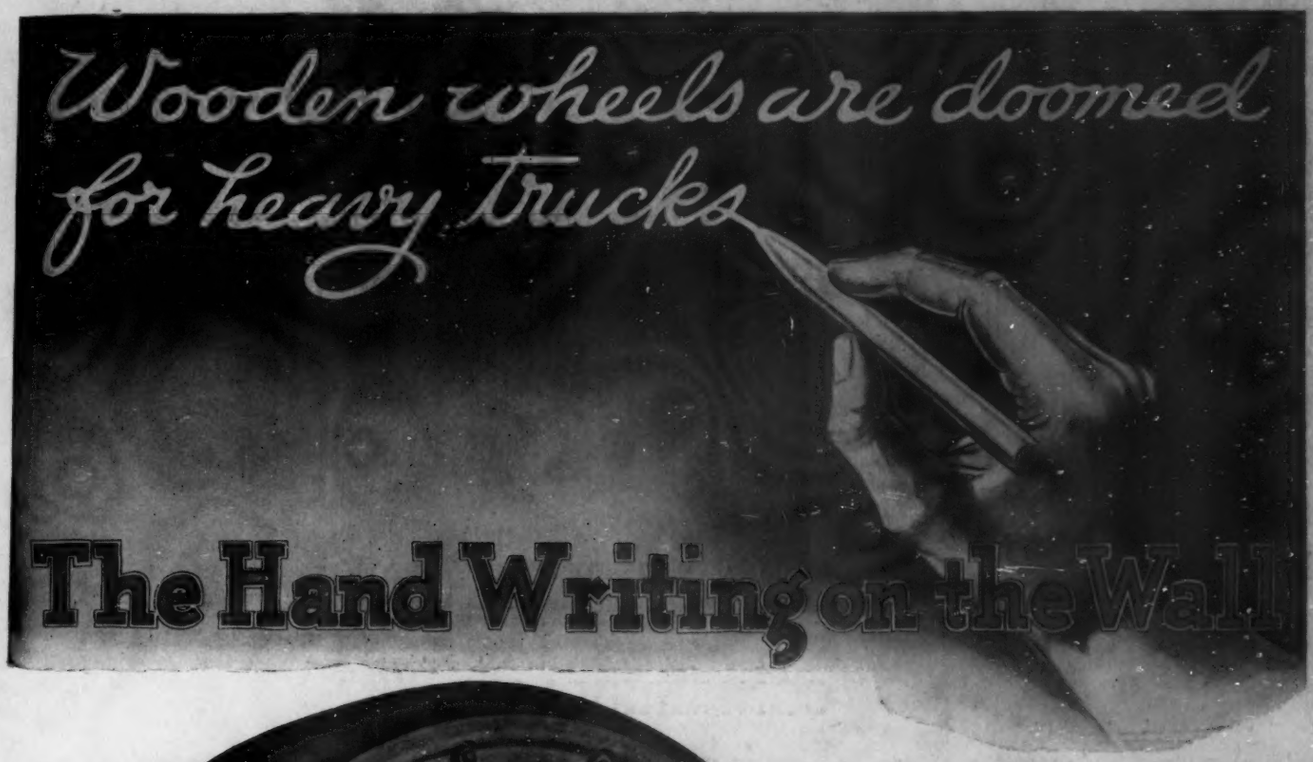
THE IRON TRADE REVIEW

Single Copies 15 Cents | CLEVELAND, JUNE 29, 1916 | Four Dollars a Year



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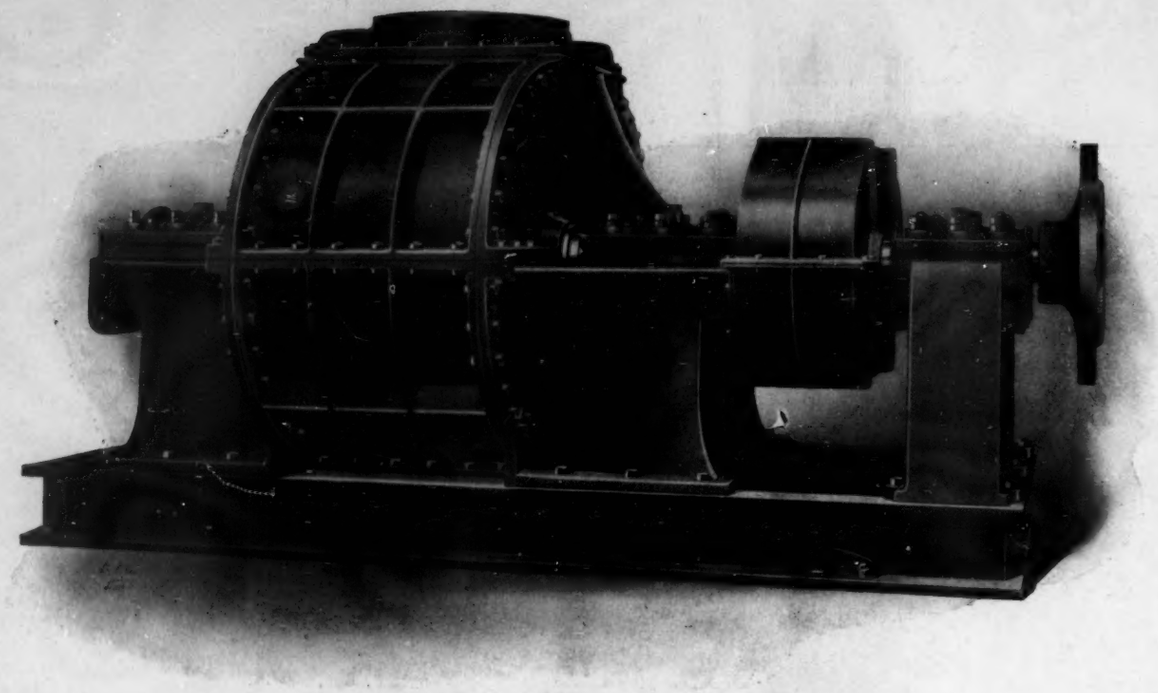

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THE IRON TRADE REVIEW

Vol. LVIII Cleveland, June 29, 1916 No. 26

Buyers for Allies Are Persistent

Inquiry for Pig Iron, Semi-Finished and Finished Materials for Export is Very Active

HEAVY foreign demand for pig iron and finished materials is checking the sagging tendency of prices. If hostilities in Mexico develop to the extent now feared, there will be a decided increase in buying by the government of munitions and equipment of various kinds, but the volume of demand of this kind is not expected to be large in the near future.

Pig Iron

The continued inquiry for pig iron for export is a very important factor. A recent heavy sale for export to Italy will take out of the market for the next two months the output of the largest merchant furnace in eastern Pennsylvania and a furnace in western Pennsylvania will be engaged for several months in making pig iron for export to the same country. Numerous furnace companies which have received foreign inquiries during the past few days have not quoted on account of inability to give deliveries at any time this year. The domestic market is very dull and the only transaction of importance is the purchase by an eastern Pennsylvania steelmaker of a round tonnage of basic for third quarter delivery at $19, delivered.

Cotton Ties

The cotton tie market has opened at $1.35 per bundle, the highest price which has ever prevailed for this product. Last year the price was 85 cents, and in 1914 it was only 65 cents. The cotton crop this year will require 45,000 to 60,000 tons of cotton ties, but some of this will come from stock now in hand.

Shapes and Plates

On account of the high prices prevailing, the public service commission, of New York City, has rejected bids for 52,000 tons of steel for subway and elevated work. A Canadian company, which is figuring on a large Russian order for cars, is inquiring for 15,000 tons of shapes. The Pennsylvania railroad is in the market for 5,000 tons of bridge material. The three new bulk freighters ordered by M. A. Hanna & Co. will require about 10,000 tons of shapes and plates, to be furnished by the Carnegie Steel Co. The Japanese ship yards, which recently bought 10,000 tons of plates, are anxious to place orders for about 50,000 tons additional. British buyers are also about to buy round tonnages of ship plates. Important domestic consumers are sounding the market on prices for next year. The naval program of the government will require ultimately a very large tonnage of steel.

Billets and Sheet Bars

There is very heavy inquiry for sheet bars from foreign countries and some of the tonnage is very attractive. Domestic consumers in Cleveland and other centers are having trouble in buying enough billets and sheet bars to keep their mills in operation. There is remarkable irregularity in prices, which show a range of as much as $10. Every transaction seems to be a law unto itself.

Railroad Buying

Recent orders from foreign governments include 20,000 tons of light rails for portable tracks placed with a Cleveland company and 100 small locomotives for service in carrying supplies to the trenches in France, taken by the Baldwin Locomotive Works. Many railroads are deferring the placing of orders for track fastenings, as prices on some of this material have advanced 100 per cent, or about $20 a ton, since the last contracts were made.

Coke

The Reading Iron Co. has placed a contract for from 17,000 to 20,000 tons of furnace coke monthly for delivery through the last half of this year with western Pennsylvania makers, and a number of other furnace companies are in the market. Prices of furnace coke show some improvement. The rapid development of the by-product coke industry will soon place on the market a large tonnage of this coke. The Youngstown Sheet & Tube Co., which has been consuming about 65,000 tons of bee-hive oven fuel per month, expects to meet its own requirements beginning next month, when its by-product plant will be in operation.

THE OPEN HEARTH

Pig Iron Lags in Exports

A CURIOUS condition, in view of the recent tremendous demand for American iron and steel products from foreign countries, is shown by the export statistics on pig iron. It is surprising to note that despite the doubling of our steel exports during the past 18 months and the appearance on this side as prospective buyers of iron of many countries which ordinarily would supply their needs nearer home, the tonnage shipped abroad by American blast furnaces in 1915 and the rate of deliveries of 1916 to May 1 were much below those of recent full years. In 1915, our exports of iron were 224,499 tons and during the first four months of 1916 they have been 71,398 tons, or about 214,000 tons annually. Exports were 272,676 tons in 1912 and 277,648 in 1913.

There appear to be several causes for this backwardness of pig iron. The high cost of ocean carriage undoubtedly has been one. The rates quoted to European points, especially the Mediterranean, have been from one and one-half to two times the furnace price of the metal. Pig iron, being a relatively low grade product, has not been able to absorb such a transportation cost as well as finished steel. Ocean rates very recently have undergone some recession to certain points. War needs have stimulated greatly the demand for steel-making grades of iron in the affected countries. Steel is the essential material everywhere in this conflict. If our exports were analyzed, they undoubtedly would show that we are shipping more steel-making iron to foreign countries than ever before. Likewise it probably would be shown that our deliveries of foundry grades in which the south in other years has been active, have been less by as much tonnage, if not more, than our shipments of steel-making metal have increased. The foundry iron needs of the entente nations have been less than before the war or these countries have been better able to supply their inter-related necessities of this grade among themselves than they have been in steel-making iron.

There is another phase of the matter which is interesting. Our exports of scrap at present are the heaviest in our history. During the first four months of 1916 we shipped to other countries 55,139 tons, or at the rate of about 165,000 tons annually. This compares with 79,361 tons in 1915, 33,134 tons in 1914, 97,429 tons in 1913 and 105,965 tons in 1912. Apparently scrap purchases have been substituted for those of pig iron in a number of cases because of the lower cost when compared with basic, bessemer or low phosphorus iron. Likewise this material has displaced billets with some buyers for the same reason.

If, however, present demand continues, the statistics of exports will soon show a decided increase.

A Convincing Exhibit

THAT practical work of very important character is being done by the bureau of foreign and domestic commerce of the United States government has been shown in many ways during the past year. Dr. Edward Ewing Pratt, chief of the bureau, is a man who believes in putting things in such a concrete form as to be absolutely convincing, and that is what he did a few days ago in an address before the National Hardware Dealers' Association, at Boston. He said that when two or three are gathered together to discuss the subject of foreign trade, particularly exporting, it may confidently be expected that two objections will be raised. First, it will be said that the United States cannot compete with Europe in prices, and secondly, that manufacturers are unwilling to make what is wanted in foreign markets. He proposed to demonstrate that neither assertion is true and he came armed with the necessary weapons in the shape of samples of hardware which he exhibited to show what is actually being done by American manufacturers.

About a year ago, the bureau authorized each of its commercial attaches located in the 10 principal commercial capitals of the world to make investigations of the methods of marketing hardware in their respective territories, and to purchase samples of the hardware actually in use in those particular markets. Six of the 10 shipments of samples have arrived and are now on display in the New York custom house. The samples exhibited by Dr. Pratt, at Boston, were taken from among those collected by the attaches. A prominent hardware expert made the selection of some 20 samples of hardware, principally tools, and he obtained American-made hardware as nearly like the foreign samples as he could possibly find. An effort was made to purchase tools of as nearly as possible the same grade and quality as the foreign samples furnished by the commercial attaches.

Dr. Pratt compared the foreign and American tools as to both quality and price. For example, a riveting hammer manufactured and widely sold in England cost 36 cents and retails for 76 cents. An American-made riveting hammer is superior, especially as regards the handle, and was purchased by the retailer for 32 cents and sold by him for 50 cents. In a number of other cases, it was shown that the American product was lower in price and superior in quality to the foreign-made product. An interesting case was that of a sample of a "Yankee" razor, which is Yankee in name only, for it was manufactured in Germany and sold in Rus-

THE OPEN HEARTH

sia. The invoice price is $1.19, and the retail price in Russia is $2.45. Dr. Pratt says that many razors are manufactured in the United States which are as good as, if not better than, this German-made razor and sell wholesale for much less than $1.19. The American razor which he exhibited retails for $1, with a liberal discount to the retailer. In the manufacture of the German razor, a careful attempt was made to imitate not only the American construction and the American packing, but also the American trade mark and other comparatively minor points. "When," said Dr. Pratt, "we compare the two razors as to compactness and finish, it will occasion little surprise that the German manufacturer wishes to attach to his product a name suggestive of the United States."

If the export trade of the United States is to be greatly extended, one of the most important things to be done is to convince the American manufacturer of his own ability to compete in foreign fields. While, of course, it will not always be aasy to turn out products that will successfully compete with the most skillful manufacturers of other lands, American manufacturers are already doing much more than even they themselves realize and the possibilities for further achievement are almost unlimited.

Henry Ford may make cheap automobiles by the million, and he may keep a few of his employes from answering the call to arms, but he can never cheapen his country's flag. He is the one conspicuous manufacturer of the country who is not showing genuine patriotism.

Danger of Doing Much Harm

CONSTRUED literally, section 10 of the Clayton anti-trust act would play havoc with the great railroad systems and supply houses of the country. Effective on Oct. 15, of this year, the section authorizes the interstate commerce commission to establish rules and regulations governing the manner in which railroads may purchase equipment. It prohibits a railroad from making contracts with any concern when the carrier has upon its board of directors, or as its president, manager, or as its purchasing or selling agent, etc., one who has "any substantial interest" in such a supply house, unless the contracts are based upon the "most favorable bids". The "most favorable" bids are to be determined by "competitive bidding" through rules and regulations to be prepared by the commission. The section affects all important carriers, because only those purchasing $50,000 or less a year are exempted from its operation. Fine and imprisonment or both constitute the penalty for violation of the law.

For some reason, not yet made plain, railroads will have to advertise in a Chicago daily paper for bids. They must also prepare an endless number of specifications and drawings upon demand of any prospective bidder, whether he does or does not seriously contemplate submitting figures. Then, also, all details as to transactions must be filed with the commission. The tremendous expense and annoyance to which the railroads will be put from these sources alone can hardly be imagined. But much greater injury to the railroads, as well as to supply houses, lies within the law, if it is applied literally.

Full discussion of the issue took place before the commission last week. It was shown by Alfred P. Thom, general counsel for the Southern Pacific railroad, how the law could be so operated that big railroad systems of the country, now closely coordinated, and efficiently maintained, would be broken into many small units by strict application of this section. Any person who is a director, or stockholder, or otherwise financially interested in a railroad or any of its branches having a "substantial interest" in a supply house, would provide cause to bar that railroad or its branches from dealing with such a supply house. Applied to one case, this rule would have to be made to apply to all. Thus single railroad systems would be converted into a vast number of inefficient buying units.

It is obvious that the "most favorable" bid is not essentially the lowest bid. Many railroads have perfected a system of buying material from supply houses in which they may be interested through a plan of standardization. Equipment wanted is made uniform by particular supply houses which carry the required special appliances, such as jigs, gages, dies, etc. Prices asked may be higher than those which a new bidder might demand, yet material offered by the latter may prove entirely unsatisfactory. Even bidders who have no source of assured supply could submit the lowest figures, and be given the contracts, whether they would be able to fill them or not. The fact that they could not fill them would not be made known to the commission, if it could be concealed. They would be compelled to turn the contracts to other sources, if the orders were to be filled upon the basis of their undesirable bids. It will be observed how this class of bidders would get their hands into the treasuries of the helpless railroads, put there by the law itself. Moreover, such a system would result in virtually blacklisting legitimate supply houses.

This loosely drawn, indefinite section, should be interpreted so as to work as slight a hardship as possible. It was aimed to correct unquestionable abuses, but threatens to do more harm than good.

Prices Present and Past

(Yesterday, a month ago, three months ago and a year ago.)

Quotations on leading products June 28, average for May, 1916, average for March, 1916, and average for June, 1915. Prices are those ruling in the largest percentage of sales at the dates named.

	Prices June 28, 1916.	Aver. for May, 1916.	Average for Mch., 1916.	Aver. for June, 1915.
Bessemer pig iron, Pittsburgh	$21.95	$21.95	$21.55	$14.58
Basic pig iron, Pittsburgh	18.95	18.95	19.20	13.54
No. 2 Fdy. pig iron, Pittsburgh	19.45	19.325	19.45	13.45
Northern No. 2 Fdy., Chgo	19.00	19.00	18.70	13.00
Lake Superior Charcoal, Chgo	19.75	19.75	19.75	15.25
Mall. Bess., Chgo	19.50	19.50	19.20	13.00
Southern No. 2, Birmingham	14.00	14.95	15.25	9.57
Southern Ohio No. 2, Ironton	18.00	18.46	18.00	12.50
Basic, eastern Pa	19.00	20.00	20.00	13.50
No. 2X Virginia furnace	18.50	18.00	18.25	12.50
No. 2X foundry, Philadelphia	20.00	20.50	20.25	14.25
Ferro mang., Balti., (1917)	175.00	175.00	150.00	105.00
Bessemer billets, Pbgh	40.00	44.25	40.60	19.87
Bess. sheet bars, Pbgh	40.00	44.25	41.00	20.37
Op.-h'th sh. bars, Pbgh	40.00	44.25	41.00	20.37
Open-hearth billets, Pbgh	40.00	44.25	40.60	19.87
Steel bars, Chgo	3.10	3.00	2.50	1.39
Steel bars, Pittsburgh, contr	2.50	2.50	2.34	1.20
Iron bars, Philadelphia	2.559	2.559	2.559	1.20
Iron bars, Cleveland, local del'y.	2.40	2.40	2.40	1.15

	Prices June 28, 1916.	Aver. for May, 1916.	Average for Mch., 1916.	Aver. for June, 1915.
Iron bars, Chgo. mill	$2.35	2.35	2.19	1.15
Beams, Chgo.	3.10	3.00	2.50	1.39
Beams, Pittsburgh, contr	2.50	2.50	2.40	1.20
Beams, Philadelphia	2.659	2.659	2.409	1.30
Tank plates, Pbgh., contract	2.90	2.75	2.50	1.15
Tank plates, Chicago	3.50	3.30	2.67	1.31
Tank plates, Philadelphia	3.909	3.909	3.409	1.30
Sheets, blk., No. 28, Pbgh	3.00	2.925	2.75	1.80
Sheets, blue an., No. 10, Pbgh.	3.00	3.025	2.87	1.35
Sheets, galv., No. 28, Pbgh	4.50	4.88	4.82	4.46
Wire nails, Pittsburgh	2.50	2.50	2.38	1.55
Connellsville fur. coke, contr	2.50	2.60	2.80	1.65
Connellsville fdy. coke, contr	3.25	3.50	3.90	2.25
Heavy melting steel, Pbgh	16.00	17.12	17.95	11.75
Heavy melting steel, east'n Pa.	15.00	16.75	17.00	11.50
Heavy melting steel, Chgo	14.50	16.50	16.20	9.37
No. 1 wrought eastern Pa	19.75	22.50	22.50	12.75
No. 1 wrought, Chgo	15.00	16.37	16.15	8.75
Rerolling rails, Chgo	15.75	17.25	17.20	10.00
Car wheels, Chgo	12.50	13.10	14.05	9.87

(For Additional Prices See Page 1442.)

Foreign Inquiry is Still Active

Large Tonnages Eagerly Sought by the Entente Allies and Some Sales Have Resulted

New York, June 27.—The tonnage of the current market in great part is made up of foreign business which continues briskly active. The week has brought out a number of additional sales for export, including one lot of 2,000 tons of valley bessemer, several lots of low phosphorus and a reported transaction of 10,000 tons of bessemer, chiefly to Italy. As high as $24.50, New York, or about $22.35, valley, has been obtained on bessemer, but this is $1 above the usual prices. It is interesting to note that some foreign buyers who are figuring on deliveries after Jan. 1 have inserted in their contracts a clause permitting the cancellation of unshipped portions of the order, in the event of the ending of the war. New inquiries include 10,000 tons of charcoal, 10,000 tons of bessemer, 4,000 tons of bessemer, 1,000 tons of low phosphorus and other lots for Italy; 6,000 tons of steel-making grades for Spain; about 2,000 tons of foundry for Holland; and various other tonnages put out by different exporters. Ocean freights have evidenced no further change and the heavier demand for Italian ports has reduced the offerings to that destination.

The quiet domestic market is dominated by resale iron, which holders seem more anxious to dispose of and are accepting concessions. This resale metal is going about $1 under furnace quotations, and it gives the market a soft appearance. Tidewater No. 2X prices now are about $19.75 to $20.25, or 25 cents lower. The American Locomotive Co. bought 950 tons of Virginia foundry for Richmond. A resale lot of 1,000 tons of foundry was taken by a consumer in this district. An equipment maker wants 500 tons of high silicon for St. Louis.

Active Foreign Demand

Philadelphia, June 26.—Growing appreciation is shown in the trade in the importance of the continuing heavy demand for pig iron from foreign countries and there is much speculation as to the influence of this business upon the domestic market. It is apparent that a large amount of tonnage is being taken out of the home market by these export orders. This is shown by the fact that the largest merchant furnace in eastern Pennsylvania, which is operated by the Schuylkill valley seller of the round block of bessemer to Italy fully reported last week, will be run entirely on the order for the next two months. The foreign inquiries for iron before makers in this territory continue numerous and of heavy tonnage and there have been some further sales from this district. Italy took 1,000 tons of low phosphorus each from two eastern makers at about $33, tidewater, and another sale of 1,000 tons of the same grade is reported. Among the new inquiries here are 10,000 tons of charcoal iron and 5,000 tons of bessemer for Italy, 10,000 tons of low phosphorus and 10,000 tons of high silicon, high phosphorus iron, destination not given and numerous others. The extreme dullness of the domestic market has spread out by contrast with the activity for foreign account. With various sellers, bookings of the past week have been the lightest in months. A considerable demand for standard low phosphorus is shown and one seller in the week disposed of 3,000 to 4,000 tons for this year at unchanged prices. The free supply of this grade for this year is very small. Foundry and basic prices are soft. An eastern Pennsylvania steel maker was the buyer this week from a nearby maker of several thousand tons of basic for third-quarter at about $19, delivered. An eastern Pennsylvania furnace which is resuming operations has been seeking a backlog of orders with offers to sell at $19, furnace, or $19.85, Philadelphia, for No. 2X, but has been able to interest few buyers. It

(*For complete prices see page* 1442.)

now appears that the minimum of the Philadelphia market is more like $19.75 for No. 2X. The Baldwin Locomotive Works has been the buyer of 500 tons of forge.

Heavy Export Inquiry

Pittsburgh, June 27.—Heavy inquiry exists for bessemer iron for export, but scarcely any activity is reflected by the domestic market. Entente nations are negotiating for lots of bessemer iron, ranging from 5,000 to 20,000 tons, but leading sellers in western Pennsylvania are not entertaining inquiries, on account of inability to meet specifications for delivery. An inquiry for 500 tons of foundry iron for shipment to Holland has come out within the last few days.

Small lots of No. 2 foundry and malleable iron are being sold at $18.50, valley, and no trace of sales below that figure can be found. One dealer has sold 1,500 tons of No. 2 foundry at $18.50, valley, for delivery the last six months of this year. The Colonial Steel Co., Pittsburgh, has not yet closed negotiations for 10,000 tons of basic iron for shipment in the last four months of 1916, and January, of 1917. Basic iron is being held at $18, valley. Bessemer iron is quoted at $21, valley, as a minimum. Recent reports of a sale of 40,000 tons of basic iron apparently refer to a transaction which was closed a couple of months ago. Clair furnace of M. A. Hanna & Co., Sharpsville, Pa., was blown in on bessemer last week, after having been relined.

Sales Light

Buffalo, June 27.—Sales by the Buffalo furnaces during the past week did not exceed 4,000 tons, according to the reports of the producing interests. The general inquiry and the sales continue light, as reported a week ago. The stacks of the district are sold up practically solid over a long period and are not seeking to book additional tonnages at this time or to make concession prices in order to bring out the buyers. Some resale iron has figured in the market at $18 to $19 on the basis of No. 2X foundry, malleable and other grades, but the general schedules remain as previously quoted.

Heavy Foreign Inquiry

Cleveland, June 27.—Numerous inquiries for bessemer pig iron are being received by Cleveland firms, but no sales have been announced and it does not seem probable that Cleveland makers will be able to take orders, as they cannot give deliveries as required by the foreign buyers. As the inventory period approaches, deliveries to foundries are being somewhat retarded, but, on the whole, shipments are very satisfactory, and makers are not alarmed on account of the continuance of the dull period.

Foreign Buying Helps

Birmingham, Ala., June 26.—With the consuming trade more fully realizing the difference between the apparent advantages and the real disadvantages of resale metal when cash and storage, commission and interest charges are considered, and the beginning of what appears to be developing into a real opportunity to ship abroad in quantities, the Birmingham iron makers have taken on some comfort. Among recent foreign bookings are two of 1,000 tons each and one of 3,000 tons, all for Italy, and by two makers. The orders went under the price for domestic iron. One shipment will be made via Savannah at a freight rate of $28. High as this is, it is lower by $6 to $8 than the maximum heretofore offered and $2 below the minimum. Rates of $1.50 per 100 pounds and $30 per ton out of New Orleans have not resulted in orders. A sale of 500 tons of high silicon at $15.25 denotes a basis of $14.75. A car of high manganese brought $16. The Anniston interests, which are to resume by the middle of July after years of idleness, are quoted as having booked about 2,500 tons for the rest of the year at $15 and $15.50, the bookings at the higher figure having been made some time ago. No furnace interests are quoting below $15, but it is admitted that on large transactions that price would be shaded. Cost of manufacture is around $9. Even at $13.50 there would be a 50 per cent profit.

Chicago Iron Dull

Chicago, July 27.—Quiet conditions continue in the Chicago market, both northern and southern iron lacking interest and few inquiries being made. Northern makers regard the situation as natural under the conditions and are awaiting developments with sufficient tonnage on books for last half to give a comfortable feeling. Prices remain at former levels—$19, furnace, for No. 2 foundry, and $19.50, furnace, for malleable.

Some interest is being manifested in the malleable situation as contracts for castings usually are made at the middle of the year by agricultural implement manufacturers. Whether this business will be in usual volume is a question, as the steel situation seems likely to curtail operations and, if so, malleables will not be needed in as large tonnages as usual.

Southern iron is equally quiet and it is difficult to determine actual prices in the absence of sales. Last half iron appears to be available at $14.50, Birmingham, from producers, and at lower levels from warrant holders. For first half of 1917, $15, Birmingham, appears to be the asking price. Southern furnaces apparently have not as large a backlog as northern and are not viewing the situation as calmly.

A recent purchase of iron, mostly southern high silicon, by the American Brake Shoe & Foundry Co., went largely to a Tennessee stack recently put into blast, and it is understood a concession was made to obtain the business. A small tonnage was taken by a northwestern furnace for a nearby plant.

Still in the Dumps

Cincinnati, June 27.—The pig iron market has made no headway towards pulling itself out of the rut it has been in for the past month. The situation is very slow, and furnaces in both the south and southern Ohio are doing very little new business. Producers do not appear alarmed, as a better buying movement is expected before the early fall. It is known that a large number of melters in this territory have not enough iron on hand to run them through the last quarter of this year. The growing demand for southern basic iron is also expected to have its influence upon foundry iron, for this latter will become more and more scarce as furnaces are gradually put upon basic iron.

Prices have not changed during the past ten days. Occasional small lots of southern resale and furnace iron are being sold at $14, Birmingham basis, for No. 2 foundry, for any delivery over the remainder of this year. Iron for the first half of 1917 is being sold by resale dealers at $14 and $14.50, but furnaces are holding at $15 for that delivery. Southern Ohio furnaces have not lowered quotations below $19, Ironton basis, for No. 2 foundry, for 1916 and the first half of 1917, principally because they are well sold up on basic iron. Southern Ohio resale dealers are offering No. 2 foundry at $18 and $18.50, for 1916 delivery. Silvery iron produced in this district is selling from $27 to $29, furnace, for 8 per cent silicon for 1916 shipment. This same grade can be had from southern stacks at $25, furnace.

Warrant Iron at $14

St. Louis, June 27.—Pig iron transactions have been quiet in the St. Louis district for the last week, and there has been very limited buying.

(*For complete prices see page* 1442.)

Buyers seem to have made large purchases while the market was advancing, some time ago, and are not in need of iron. Much warrant iron has been offered, some as low as $14, Birmingham, and some of it has changed hands, buyers apparently believing that it was furnace iron.

Foreign Billet Buyers

Are Very Anxious to Place Orders in the United States —Stream of Inquiries is Being Received

Philadelphia, June 27.—Increasing pressure is being brought by foreign buyers of billets and other semi-finished forms upon makers and some of the latter in eastern territory who have been reserving tonnage for the domestic trade are beginning to take more interest in these propositions, since the home buyers are slow to take up the lots set aside for them. A steady stream of export inquiries for billets is coming out and some of these are most attractive from a mill standpoint, both as to tonnage and chemical specifications. Frequently the quantities in single inquiries run 5,000 to 10,000 tons. English buyers have open inquiries before certain eastern mills asking them to quote whenever they can spare material. On one current inquiry for 2,000 tons of open hearth billets for export, eastern makers this week quoted $50, seaboard, their regular price. The week included a sale of 1,000 tons of sheet bars from the Pittsburgh district to Italy, which is also reported to have paid $55, seaboard, on a recent lot of 5,000 tons of 4 x 4-inch open hearth billets. A considerable variety of prices on bessemer semi-finished steel is shown. A sale of bessemer billets was made this week at $47, western Pennsylvania mill, and bessemer slabs were offered here at about $42, Pittsburgh, or $45, delivered. Open hearth ingots of large size have been quoted to middlemen at $36, Pittsburgh.

Semi-Finished Held at $40

Pittsburgh, June 27.—Many manufacturers of billets and sheet bars have re-arranged sliding scale contracts for shipments during July, August and September, it being generally understood that both sheet bars and billets will command not less than $40, mill, during the third quarter of this year. That figure is from $5 to $7.50 a ton above the price at which many consumers obtained tonnages for delivery the second quarter of 1916. Because of higher prices of sheet bars, it is likely that prices of finished products will reflect further strength immediately after the close of the first half of this year. Demand for semi-finished products is as heavy as ever and no surplus is reported. Many manufacturers are not rolling sheet bars in large quantities, preferring to make billets for the manufacture of war material. Discarded billets frequently are being offered at slightly less than prevailing prices, although such sales have not affected the market to any appreciable extent.

Futile Efforts to Buy

Youngstown, O., June 27.—Some consumers who are not covered on sheet bars for the third quarter have tried to line up additional tonnages in this district during the past few days. One interest is understood to have tried to place 10,000 tons at $42, but without success. Producing mills are well fortified on future business and despite the fact that production is running well beyond what was previously considered 100 per cent, there is practically no steel for sale. Billet producers are also well covered, most mills being fully sold against their last half production. Inquiries continue for shell steel and two Ohio river steel producers closed this week for round tonnages. Owing to the poor market for discards, shell steel makers are generally remelting their scrap.

Scarce in Cleveland

Cleveland, June 27.—There is a scarcity of billets in the Cleveland market. Local mills are not able to turn out enough steel to meet the demand and in some cases mills have been compelled to suspend for two or three days at a time on account of not having an adequate supply of semi-finished material. Buyers and sellers are having considerable difficulty in agreeing upon prices and there is apparently a deadlock at the present time.

Nuts, Bolts and Rivets

Pittsburgh, June 27.—Manufacturers of nuts, bolts and rivets in western Pennsylvania say prices continue to harden and doubt is expressed in some quarters whether additional tonnages could be purchased at prevailing quotations. However, no formal changes in prices have been made recently. Deliveries to car and ship builders involve tremendous tonnages.

(*For complete prices see page* 1442.)

Steel Pipe

Recent Orders Include About 15,000 *Tons for Western Oil and Gas Interests*

Pittsburgh, June 27.—Western oil and gas interests recently have closed for about 50 miles of steel pipe, involving about 15,000 tons. A number of attractive inquiries are pending, but manufacturers, in most instances, are unable to entertain them, on account of inability to make desired shipments. Expected advances in price have failed to materialize, although the trade believes that revised cards, providing higher quotations, will appear shortly.

Demand for boiler tubes is extremely heavy. Most mills are unable to promise material for delivery before Dec. 31, next, and prevailing quotations necessarily are regarded as nominal, since makers, it is apparent, would not sell at formally published prices.

Wire Products

Some Inquiries Believed to be Connected With the Federal Government

Pittsburgh, June 27.—A number of inquiries for wire products have come out recently from sources believed to be indirectly connected with the United States government, although manufacturers have received no direct requests for quotations from federal authorities. Negotiations for barbed wire and staples for shipment abroad continue to involve rather heavy tonnages, but no large orders have been placed recently. Specifications for shipment to domestic consumers have fallen off slightly, although they still run considerably ahead of shipments. No formal announcement of any change in prices has been made recently, despite expectation to the contrary.

Cold Rolled Strip Steel

Pittsburgh, June 27.—Manufacturers of cold rolled strip steel have not opened books for shipment after Dec. 31. For delivery the latter part of this year, contracts are being accepted at a range from 6c to 6.50c, and as high as 7c and even above is being paid for prompt delivery. Some mills do not manifest any interest in inquiries for prompt shipment.

The Pressed Steel Products Co., Sharon, Pa., has completed plans for the erection of a building for the manufacture of steel drums, used in shipping oil.

Sheet Orders

Show a Lull Following Recent Buying —Closing for the Fourth

Youngstown, O., June 27.—Few orders for sheets were placed during the past few days. Specifications on contracts continue to come in freely, but new orders are infrequent. With the exception of galvanized products, this lull has had no weakening influence on the market. In the case of the coated product, a sympathetic decline has followed the drop in spelter, and more business has been taken this week at 4.50c.

The present lull is ascribed by sheet makers to several factors, including the well fortified position of some consumers on future deliveries, and to the reluctance of the consuming interests to assume obligations immediately prior to the July 1 inventory period. Within 10 days or two weeks, the sheet mills expect to witness a resumption of buying.

Galvanized sheets are now more firmly entrenched at the 4.50c to 4.65c level. Several mills in competitive districts are understood to be seeking this business at the 4.50c level. This factor coupled with spelter's consistent drop has brought the level for the heavier gages to the quoted minimum. The volume of business closed is comparatively light and many producers who have been out of the market for months have made no plans to resume.

Black sheets are firm at 3c, with some business being closed at 2.90c. Advancing costs of sheet bars and labor after July 1 are expected to have a stiffening influence on all grades of sheets. Blue annealed sheets continue strong, 3.25c being easily obtained on No. 10 gage.

Most of the mills will be shut down for four days from July 1 to July 5. Others may close for a longer period to permit complete inventories to be made. Stocks of sheets are generally low, most makers having pushed sales from warehouse, particularly of slow-moving sizes that in some cases had been on the floors for several years.

Still Getting 3.75c

Philadelphia, June 26. — Eastern Pennsylvania sheet makers report their continued ability to obtain without much difficulty, 3.75c, Pittsburgh, or 3.909c, Philadelphia, on No. 10 blue annealed from buyers in nearby territory for delivery during the next six to eight weeks. Orders at 4.00c, Pittsburgh, however, at which there were some recent bookings, are scarce. The market shows fair activity.

Strong, But Quiet

Pittsburgh, June 27. — Specifications against contracts for steel sheets are heavy, although new buying is light and black and galvanized products still reflect some irregularity. No. 28 gage galvanized sheets recently have been offered at 4.60c and reports of sales at 4.50c are heard. Most manufacturers are asking 3c and above for bessemer black sheets, but the 2.90c price has not entirely disappeared for No. 28 gage. Blue annealed products, however, are decidedly strong and doubt is expressed if material could be purchased at prevailing minimum figures, although they have not been officially withdrawn. Since manufacturers of sheets, dependent upon the open market for raw material, soon will be paying advanced prices for sheet bars, it is natural to assume that prices of sheets will stiffen immediately after July 1, when sliding scale contracts for the third quarter take effect.

It is too early to determine how threatened trouble with Mexico will affect the general sheet market. If the United States becomes engaged in hostilities of any kind, however, heavy tonnages of sheets likely will be used for making barracks.

Sheets for Autos

Buffalo, June 27.—The Seneca Iron & Steel Co., Buffalo, has received an order for a large tonnage of sheets for automobile work. The demand for this line continues strong.

Active in Cleveland

Cleveland, June 27.—Cleveland plants recently have booked large tonnages of light plates and blue annealed sheets and are doing their utmost to increase production in order to meet the demands of the trade. Sales of blue annealed are being made at 3.25c, Pittsburgh, for No. 10 without difficulty.

Sheets Holding Well

Chicago, June 27.—Although considerable irregularity exists in the sheet market, prices as a rule are maintaining their level, except in the case of galvanized, which are somewhat lower on account of a decline in the price of spelter. Black sheets are quoted at 2.99c to 3.09c, Chicago, for No. 28 gage, while blue annealed may be obtained from 3.19c to 3.69c, Chicago mill, with demand excellent. Some jobbers are making unusually good prices on blue annealed sheets from store, quoting 3.40c, Pittsburgh, for No. 10 gage and 3.60c, Pittsburgh, for No. 16 gage.

Although spelter has reached a level where it might be used advantageously, the leading independent maker of sheets in this city probably will not resume operation of its galvanizing department during the present year, as its supply of raw steel already has been apportioned among other departments, where need is strong.

(*For complete prices see page* 1442.)

Tin Plate Stiffens

Pittsburgh, June 27.—Manufacturers of tin plate could sell material without difficulty at $7 per base box, if they were in a position to meet specifications for nearby shipment. Most mills in this district are sold up for the remainder of the year and some manufacturers cannot promise additional tonnages until the latter part of the first quarter of 1917.

Cast Iron Pipe

Is Weak at Present—Only Two Tonnages Important

Chicago, June 27.—Municipalities continue to buy cast iron pipe sparingly and only two tonnages of importance are now being considered. Bids were to be taken at Waukegan, Ill., June 26, on 450 tons, and at Milwaukee, June 29, on 1,000 tons, mostly 48-inch pipe for sewer work.

Pipe makers are busy and their aggregate tonnage is greater than would be believed in view of the shortage of advertised lettings during the present year. To make up for this lack, there has been considerable buying without advertising and specials for industrial use are also in heavy tonnage.

Warehouses Busy

Cincinnati, June 26.—Warehouses report that they are unable in a number of cases to supply the demand for reinforcing bars and other building materials. Considerable difficulty is being experienced in obtaining deliveries from mills. Prices are unchanged. Cold rolled bars, which dropped last week from the list plus 20 to 10 plus, are holding at the latter figure. Shapes and plates are quoted from 3.20c to 3.50c, and hot rolled bars from 3.20c to 3.75c, all f. o. b. Cincinnati.

Slow Mill Delivery

Cleveland, June 27.—Warehouses report that business is as good as it can be with the depleted stocks which are now on hand. Much difficulty is experienced in obtaining deliveries from mills.

The Riter-Conley Mfg. Co., Pittsburgh, owned by the McClintic-Marshall Co., that city, has leased the plant of the Ellicott Machine Corporation at Fairfield, Md. Steel barges will be built at the Fairfield works.

Plates for the Japanese

Land of the Mikado Would Like Very Large Tonnage—
British Shipbuilders Are Also in the Market

Philadelphia, June 27.—So much tonnage is being sought by foreign buyers at present that platemakers in eastern territory are in doubt as to how much they should book in view of the sustained and heavy activity of home buyers. Japanese shipyards, which recently bought 10,000 tons, are offering to take 40,000 to 50,000 tons additional. Some of these further orders are about to be closed. British buyers also are on the verge of placing some round tonnages of ship plates. Italy has received quotations on one lot of 2,500 tons of ship plates. Large buyers, including the Pennsylvania railroad, continue to sound out makers for prices for next year and some of them have asked that prices be guaranteed against decline, which the mills will not do. The Pennsylvania railroad wants 7,000 tons per quarter for next year for Altoona. A new boat proposition requiring 3,000 to 4,000 tons for third or fourth quarter came out this week, but is held up because the buyer could not get the deliveries desired. The Carnegie Steel Co. is the low bidder on 5,000 to 6,000 tons, mostly plates, for the navy department for Norfolk, on which it quoted full prices for shipment at its convenience. Some eastern mills asked 4c, Pittsburgh, for early delivery on such sizes as they could furnish. The larger eastern platemakers quote unchanged from 3.75c to 4c, Pittsburgh, but there are offers of 3.50c, Pittsburgh, on the narrower widths by both eastern and middle western mills. By reducing the tensile strength from 63,000 pounds per square inch to 60,000 pounds and by increasing the thickness, the makers are able to use softer steel for marine boiler plates, and they now are getting out old orders of this kind. The increased amount of steel, however, costs the buyer more. New orders for marine boiler steel continue to be refused pending the modification of the present government standards.

More Hanna Boats

Cleveland, O., June 27.—The plate market in the Cleveland district continues strong with 3.50c, Pittsburgh, as the prevailing rate on light plates and 4c on heavier plates. The Carnegie Steel Co. has taken a contract for 3,200 tons of plates and shapes for the new bulk freighter to be build for M. A. Hanna & Co. by the American Ship Building Co. The Hanna firm has just ordered two more 10,000-ton steamers to be built by the American Ship Building Co. The steel, about 6,500 tons, has not been placed.

Still High

Pittsburgh, June 27.—Frequent reports have been heard at this center recently that eastern Pennsylvania mills have sold upwards of 20,000 tons of plates for export to Japan at 4c and above. Such sales are not at all surprising, since it has been increasingly difficult the last eight months to obtain plates for prompt shipment. The domestic market has offered tangible evidence of strength the last few days, no sales at less than 4c for nearby delivery being reported. Leading manufacturers continue to ask 2.90c for shipment at their convenience, although the 2.75c price has not entirely disappeared, despite contrary reports. Most mills have enough tonnage on their books to keep plants operating six months and longer.

Plates Hold Strength

Chicago, June 27.—No sign of slackening in heavy demand for steel plates has been noted. Every line consuming this form of finished steel is seeking more material, car builders, tank and boiler makers, ship builders, all endeavoring to obtain more material than mills are able to turn out.

The nominal mill price remains 3.09c, Chicago mill, for delivery at convenience, while prompt material may be obtained from makers in Ohio at 3.50c, Pittsburgh. Almost any reasonable delivery can be given by some makers, who have avoided taking contracts into the future.

Bar Buying is Light

But Heavy Specifying is Expected as Second Quarter
Contracts at Lower Prices Expire

Philadelphia, June 27.—New buying is small and makers also report this week's specifications have been lighter. It is expected there will be a considerable movement of orders against second quarter contracts which expire this week, as these commitments are far below the current market of 2.50c, Pittsburgh. Bessemer bars for relatively quick delivery still can be had from certain makers at 2.50c, Pittsburgh, but such offers arouse less discussion than they did a few weeks past. Eastern Pennsylvania makers of munition bars are so sold up for this year that they are taking no interest in new inquiries for delivery by Jan. 1. Those for delivery after that date which seem likely to result in business are few.

Stronger Than Ever

Pittsburgh, June 27.—Steel bars, which have been the most stable item on the list of finished products for many months are stronger than ever. Indications are that belligerent European nations will continue to figure in the American market for tremendous tonnages of munitions for an indefinite period, and it is not at all unlikely, in view of our rather strained relations with Mexico, that the United States government will be a prominent factor in the market at an early date. While manufacturers of rounds now have enough tonnage on their books to keep mills running at maximum capacity for six months or longer, the federal government will not be permitted to go begging for material. The Westinghouse interests, which have been the most prominent manufacturers of munitions in western Pennsylvania, entered this work primarily for patriotic purposes and have reserve capacity which would be of great assistance to this government, should occasion demand the purchase of war material.

Bessemer steel bars for prompt delivery are being offered by at least one manufacturer at 2.50c, the price for shipment at the convenience of the mill. Agricultural implement makers continue to endeavor to obtain concessions, but they have not been able to shade the prevailing price in western Pennsylvania, so far as can be ascertained.

Steel Bars Firmer

Chicago, June 26.—Following the quiet period of two or three weeks, when specifications fell back to about an equality with shipments, demand seems to have quickened materially and specifications now are being received in excess of shipments. Some contracts for first half of 1917 are being taken by the leading interest, but the total ton-

(*For complete prices see page* 1442.)

nage of this material is small and consumers do not appear anxious to cover their requirements so far in the future.

Placing of heavy tonnages in the east for export has strengthened the market and this is reflected in the west, although practically none of the export business will be placed with mills here. This export material is not for war purposes, but will go into peaceful channels in South America, Africa and Russia, who have turned to this country for supplies formerly obtained from European nations now at war.

Soft steel bars continue unchanged at 2.69c, Chicago mill, for delivery at convenience.

Hard steel bars, rerolled from rails, are steady at 2.50c, Chicago mill, with reinforced concrete makers taking the bulk of the tonnage, while other normal users are not seeking material.

Bar Iron Steady

Chicago, June 27.—Although demand for iron bars is slight and consumers apparently are not inclined to contract for further tonnage, mills are comfortably situated with about six weeks' rolling on the books and are content to let matters rest, believing stronger demand will come by the time it is needed. All bar iron makers hold the opinion that lower quotations would not increase buying and that consumers will pay present prices willingly when they come to the point of needing material.

Prompt material, which practically means third quarter, is available at 2.35c, Chicago mill, and fourth quarter tonnage is being booked in occasional small lots at 3.40c to 3.50c, Chicago mill. The maximum quotation, formerly made on third quarter business, did not hold and apparently will not become general for fourth quarter business, at least until considerable tonnage has been booked.

Some contracts for bar iron have been cancelled because of the inability of consumers to find sufficient labor to use it, and although this was desirable tonnage at desirable price, mills have allowed cancellations to be made.

Shafting

Pittsburgh, June 27.—Cold rolled steel shafting is being offered at a range from 10 to 20 per cent off the list in carloads; as high as 5 per cent off the list is being asked for less than carloads. Warehouse stock is commanding from 20 to 40 per cent on the list. Manufacturers in this district are not soliciting additional tonnages, on account of deferred shipments.

Hoops and Bands

Pittsburgh, June 27.—Manufacturers of steel hoops and bands, unable to promise material for prompt delivery, no longer are attempting to take additional contracts. For shipment at the convenience of the mill, orders are being accepted at 2.75c for hoops and 2.50c for bands. Some mills have enough tonnage on their books to maintain present rates of operation nine months and longer.

Cotton Tie Price

Is Highest in the History of the Market

Pittsburgh, June 27.—The market for cotton ties for 1916 shipment formally was opened June 26, at $1.35 a bundle of 45 pounds, July basis. This figure, the highest to prevail in the history of the cotton tie market, is 50 cents above last year's price and is 10 cents a bundle above the highest figure predicted. Three-quarters of a cent a bundle will be added each month for deferred shipment, as against the previous extra of ½ cent a bundle, making the August basis $1.35¾ and the September basis $1.36½.

The entire production of cotton ties this year, estimated to involve from 45,000 to 50,000 tons, will be rolled by the Carnegie Steel Co., Pittsburgh; the Pittsburgh Steel Co., Pittsburgh; the Atlanta Steel Co., Atlanta, Ga., and the Conners-Weyman Steel Co., Birmingham, Ala. The Carnegie Steel Co., which probably will furnish 30,000 tons, is by far the largest single producer of ties in the United States. The Alton Steel Co., Alton, Ill., and the Sharon Steel Hoop Co., Sharon, Pa., which are equipped to roll ties, will not figure in the market this year.

The 1916 cotton crop will run between 12,000,000 and 15,000,000 bales, which will require from 45,000 to 60,000 tons of ties. Large volumes of ties are re-used each year. Furthermore, southern warehouses have some tonnage on hand, making it difficult to estimate how much new material will be required to handle the 1916 crop.

The market last year was opened in July at 85 cents a bundle, July basis, the highest figure to prevail since 1908. Cotton ties have not commanded even as high as $1 a bundle during the last 16 years, except when premium prices were paid. In 1914, ties sold at 65 cents a bundle. The following table shows the seasons' prices per bundle of 45 pounds since 1901:

1901	$0.72	1909	$0.70
1902	.80	1910	.75
1903	.85	1911	.75
1904	.75	1912	.70
1905	.85	1913	.80
1906	.85	1914	.65
1907	.95	1915	.85
1908	.85	1916	1.35

(*For complete prices see page* 1442.)

Railroad Buying

Is Slow Owing to High Prices—Some Orders from Foreign Lands

New York, June 27.—High prices are causing leading railroad systems to defer action on large quantities of track bolts, splice bars, tie plates, and other track fastenings for 1917 delivery, inquiries for which they recently placed before the principal makers. The quotations on some lines of this material have increased 100 per cent or $20 a ton and more, compared with the corresponding date a year ago. When these contracts were placed last year, the sharp advance in the movement of the steel market had not fully started. New inquiries include 5,000 to 8,000 kegs to the Seaboard Air Line for last half and 1,200 kegs to the Norfolk Southern for the same period. Leading makers are holding standard spikes for immediate specification at 2.60c, Pittsburgh.

Various builders in this country and Canada continue to figure on large Russian car order, but final action still is deferred. The car market is very quiet. The only award of the week was 57 passenger types by the Chicago & Northwestern to the American Car & Foundry Co.

The distribution of the large Russian locomotive order tentatively closed with the American Locomotive Co., the Baldwin Locomotive Works, the Lima Locomotive Corporation and the Canadian Locomotive Works remains to be settled finally, but this announcement is expected to be forthcoming shortly. The New York Central railroad has placed 25 locomotives with the American Locomotive Co. and the same builder has taken three for the United Railways of Havana, one for the Pittsburgh Steel Corporation, one for the Krajewski Pesant Corporation and one for R. J. Dorn & Co.

Passenger Cars

The Connecticut Co. has ordered 100 new steel passenger cars of the semi-convertible type, 60 of which will be furnished by the Osgood Bradley Car Co., Worcester, Mass., and 40 by the Wason Mfg. Co., Springfield, Mass. They will cost about $500,000 and will be delivered in the fall for use on its various lines in the larger cities in Connecticut.

War Orders

The French government has placed an order with a Cleveland engineering company for 20,000 tons of light rails. It is understood the rails will be used in laying portable tracks.

The Baldwin Locomotive Works has taken an order for 100 small locomotives for service in carrying supplies to the trenches in France.

Ferro Causes Annoyance

On Account of Many Restrictions Imposed by the English Makers—Domestic Competition Felt

New York, June 27.—Some inquiries for ferro-manganese free of any restrictions of the English government, are appearing in the market. It is probable that this alloy is wanted to fill export orders, as the regulations imposed by the British government on consumers of English ferro-manganese in this country provide that none of this metal, or the steel into which it enters shall be exported to countries other than the United Kingdom, France, Italy or Russia. There are also several inquiries now pending for ferro-manganese for export, including one of 450 tons.

Some recent evidences have appeared that the British government may be proposing more strictly to enforce control over the final destination of the ferro-manganese which it furnishes to this country and over the steel manufactured through its use. The British consul at New York recently took over from private firms the obtaining of the guarantees from consumers and has been asking for these formal assurances in duplicate. There is talk that a separate guarantee for each lot shipped may be required. Signs of increased irritation are abroad in the trade over these restrictions which have caused numerous consumers to buy domestic ferro-manganese more freely. The clause in the producers' guarantee which has aroused the most dissatisfaction among consumers provides in the language of the document that "the buyer will not sell to any person in the United States any steel, finished or semi-finished, in the manufacture of which the said ferro-manganese has been employed without obtaining from him a written undertaking that the same is not to be exported from the United States except to the United Kingdom, France, Italy or Russia and satisfying the seller that he will carry out such undertaking". Some difference in price now is being quoted as to whether the ferro-manganese is restricted or unrestricted. For spot carloads, $250, seaboard, was asked this week for unrestricted and $225 for restricted metal. The $225 spot price on English may be shaded and $200 probably can be done. Last half metal from abroad now may be had at $1.75 seaboard. This shows that the English makers are more alive to domestic competition and are more disposed to meet the latter prices. Domestic ferro-manganese is quoted around $225, furnace, for spot and at $175, furnace, for forward delivery. The market has remained very quiet.

Spiegeleisen is in only limited demand and is unchanged at $50 to $55, furnace, for 20 per cent, depending upon the period of delivery.

A cargo of about 3,000 tons of Cuban manganese ore consigned to western makers of ferro-manganese and spiegeleisen has arrived at Baltimore. More Cuban manganese ore is being consumed in this country at the present time than ever before. The last sales were at 75 cents at tidewater per unit of manganese for 48 per cent ore. This is the highest price ever brought by this ore.

Quiet at Pittsburgh

Pittsburgh, June 27.—Less talk has been heard recently about "huge" deposits of manganese ore in this country than at any time since prices of ferro-manganese attained unprecedentedly high levels. Domestic manufacturers of ferro-manganese, who some time ago made standing offers to buy all available tonnages of domestic ore, say they have not received enough domestic material during the last 12 months to operate a small furnace a fortnight. While no large sales of ferro-manganese have been made recently, yet it is apparent that quotations are not so high as they were several months ago. Prices of steelmaking metals have declined rather sharply, although they are still nominal.

Very Satisfactory Results

Chicago, June 27.—Development of industry brought about by the European war in the effort to supply from domestic sources materials formerly obtained from Europe is watched with interest. Results obtained in the production of ferro-manganese in this country are of especial interest, as the British supply has been practically the only source in the past.

The Miami Products Co. has been operating one of the smaller stacks of the Iroquois Iron Co. at South Chicago since the latter part of April, producing spiegeleisen and ferro-manganese. Results have been excellent and some surprises have been met. Recently ferro-manganese analyzing 85 per cent in manganese with less than 0.10 sulphur has been produced. It is claimed this is the first time so high a manganese content has been produced in this country except possibly by the electrolytic process.

(For complete prices see page 1442.)

Scrap Steel Drags

Heavy Melting Steel Declines $2.50 in a Few Months

Pittsburgh, June 27.—The market for old materials in western Pennsylvania has failed to show any signs of recuperative ability. To use a trite expression, scrap has been a drug on the market for almost two months and another month may elapse before the trend of prices is upward. Heavy melting steel, which commanded as high as $18.50 a ton not many months ago, now is offered at $16 a ton. While dealers are reluctant to sell at that figure, yet they have experienced some difficulty in obtaining it when forced to move tonnage on track. Machine shop turnings and borings have declined to $9.75 a ton and are weak at that figure. Other grades are correspondingly weak and irregular. The present comatose condition of the market is attributed largely to the heavy production of scrap through the manufacture of munitions.

One Effect of Duplexing

Philadelphia, June 26. — Duplexing operations which are being conducted on an extensive scale by eastern Pennsylvania steel makers, thereby greatly reducing the needs of heavy melting steel, are an important contributing factor to the continued weakness of this grade in this territory. Small sales of steel went this week at $15, delivered, eastern Pennsylvania, and this figure probably could be obtained on tonnages, but dealers are not disposed to accept large orders at such a price. One eastern Pennsylvania consumer will pay only $14.50, delivered, for this grade. The entire scrap market continues weak and prices are fading, as supplies coming out are in excess of the current demand. Railroad wrought is weak and turnings continue difficult to sell. A good demand for steel axles for export at attractive prices is appearing.

Extremely Quiet

Cleveland, June 27.—The scrap market still is extremely quiet, while prices of most grades of scrap have undergone little or no change for the past week. Consumers are filling only temporary requirements. Railroads have no lists before the local dealers today.

The dropping of the price of No. 1 railroad wrought from $16 to $15 a net ton, a decline of 50 cents a gross ton of axle turnings are noted. A re-

markable feature is the low price of ordinary machine shop turnings, which are quoted about $6.25 a net ton, and cast borings, quoted about $6 a net ton. These prices are only $1 to $1.50 above the low level in 1914, while heavy melting steel in the same comparison shows a difference of over $5. In other words the price of heavy melting steel has risen from $3.50 to $4.00 above that for machine shop turnings and cast borings during the same period. Furthermore it is pointed out that for the first time since January, 1913, machine shop turnings have taken a higher value than cast borings.

Hope for Reaction

Buffalo, June 27.—Dealers in the Buffalo market have been looking for a reaction to set in after the slump in prices that developed in the past few weeks. The market, however, continues slack and quiet. It is now reported that all of the carload lots in transit that were thrown upon the market as the result of plant embargoes have been disposed of, and with this off-price material out of the way, a more normal basis is expected. Dealers are waiting for the consumers to appear with inquiries for their needs. The only change in the schedule from the one reported a week ago is in old car wheels now bringing $13 to $13.50, a decline of 50 cents. The principal demand of the week was for turnings and borings and a considerable tonnage has been placed.

Chicago Prices Decline More

Chicago, June 27.—Continuation of the slow, steady decline in prices of iron and steel scrap in the Chicago market is the only feature noticeable. Although there has been some buying recently on the part of a few consumers, it has not been sufficient to stop the decline or to stiffen the market. Some material continues to be shipped into Ohio, as demand there seems stronger than in Chicago.

The scarcity of labor is having some effect on the market and consumers of busheling scrap, who have material on hand ready to be cut, are buying busheling because of inability to prepare what they have in stock.

Railroads continue to offer fair tonnages, but prices realized are not high. The Chicago, Milwaukee & St. Paul Railroad offers 1,785 tons, the Burlington Railroad 2,145 tons, the Illinois Central Railroad 1,400 tons, the Grand Trunk 5,500 tons, of which 2,258 tons are No. 1 wheels, and the Baltimore & Ohio Railroad 600 tons.

Rejecting Shipments

St. Louis, June 27.—The buying of scrap iron in this district remains at a low ebb, with hardly enough purchasing to establish a level of prices at consumers' plants. Some of the large consumers are refusing further shipments on old orders, and are rejecting cars on the slightest provocation. About the only grades selling are specialties, such as iron and steel axles, arch bars and locomotive tires. Relaying rails, however, are still in good demand and prices are stiffening. The only railroad offerings before the market is a list issued by the C., B. & Q., calling for about 2,150 tons.

Prices Uncertain

Cincinnati, June 27.—As an example of the uncertainty which exists in the iron and steel scrap iron market here, one dealer reports a sale of No. 1 machine cast at $11 per net ton, and another dealer states that he has sold the same melter a similar lot at $10 per net ton. The scrap iron market is undoubtedly passing through one of the periods that occur frequently here, during which time dealers try to rid themselves of large tonnages in their yards, and quote independently on each sale. Buyers can secure new prices each day and quotations made by dealers are good for one day only. Taking the general report of sales as a basis, heavy melting scrap could be said to be selling from $13.50 to $14, per gross ton.

Soft in South

Birmingham, June 26.—Quotations, even though at lower notches, are not well maintained. The seven-year accumulation of scrap during that off-period in the steel industry is having its effect, and, in addition, steel billets, where used for making ammunition shapes, have been so generous to the scrap heap that they have cut out other scrap material considerably.

Large Order for Motor Trucks

The Peerless Motor Car Co., Cleveland, has received an order for a large number of motor trucks for the United States government. Officials of the company would not make any definite statements in regard to this new business, but it is understood that the original order was for 1,500 trucks with more business to follow. The trucks will be shipped to the Mexican border as they are completed. It is expected that a large number of the trucks will carry portable machine-shop equipment, requiring a small lathe, drill press, forge, two arbor presses, 1½-ton hoist, bench grinder and a complete assortment of smaller tools. The machines will be operated by individual motors.

(*For complete prices see page* 1442.)

Last Half Coke

Shows Considerable Activity—Effect of By-Product Industry

Pittsburgh, June 27.—The Connellsville coke market has reflected considerable activity this week. Consumers have been covering requirements for the third and fourth quarters of the year and considerable fuel has been purchased for delivery during July. Prices have receded to a slight extent, rather heavy tonnages for forward shipment having been sold at $2.50, ovens, or 15 cents a ton below the previously prevailing price.

The growth and development of the by-product coke oven industry have further affected the market for beehive oven fuel. The Bethlehem Steel Co., South Bethlehem, Pa., now is in a position to offer from 1,000 to 2,000 tons of furnace coke a day in the open market and it is reported that a number of eastern consumers, including the Reading Iron Co., have purchased retort oven fuel for forward delivery. Another eastern consumer has dropped out of the Connellsville market, having closed for by-product oven coke. The Youngstown Sheet & Tube Co., which has been consuming about 65,000 tons of beehive oven fuel a month, will drop out of the market in July, when its by-product coke oven plant will have been completed. Corrigan, McKinney & Co. have opened negotiations for 3,000 tons of coal a day for shipment to their by-product plant, and this inquiry foreshadows the withdrawal of another beehive oven coke consumer from the market. Claire furnace of the M. A. Hanna Co. at Sharpsville, Pa., is understood to have purchased about 10,000 tons of Connellsville fuel a month for July and August delivery, at $2.50, ovens. Two eastern consumers have purchased Connellsville coke at a shade under $2.50, ovens. The market is quotable at $2.50, ovens, for future delivery. Spot furnace coke is selling at a range from $2.35 to $2.50 a ton at the ovens. Contract foundry coke now is selling at a range from $3.15 to $3.40, as against the previous nominal price of $3.50, ovens. *The Connellsville Courier,* says production the week ending June 17 was 433,176 tons, compared with 405,804 tons the week previous.

Reading Buys

Philadelphia, June 27.—A contract involving 17,000 to 20,000 tons of furnace coke monthly to extend through the last half of the year, has been closed by the Reading Iron Co. with western Pennsylvania makers. It is

not certain whether this business was taken by Connellsville or Latrobe ovens.

Softer at Cincinnati

Cincinnati, June 26.—Slight shading of prices has been done on several grades of southern coke, particularly from the Wise county and Pocahontas districts. No specific demand is out for either furnace or foundry grades and the lack of activity is having a softening effect upon prices. Furnace coke for contract shipment from the Wise county and Pocahontas fields is given from $2.85 to $3.25, ovens. New river furnace coke is quoted from $3.25 to $3.50, ovens.

Buying Expected

St. Louis, June 27.—Local sales agents are on the alert for big coke transactions that they seem to think are scheduled to take place this week in this district, but for the past week, business has been quite dull.

Mexicans May Resume

Birmingham, Ala., June 26.—Birmingham district coke continues to find a ready market at $4.25 to $4.50, the latter for spot and small lots. An appreciable amount of labor has withdrawn to other coal fields, where things are more brisk, and this has reflected, in turn, on coke. Mexican smelter interests will be ready to resume at northern Mexican plants just as soon as Uncle Sam's strong arm is in control there, and that means reopening of that market for Birmingham coke.

Shapes for Russian Cars

Are Needed by a Canadian Builder—Pennsylvania Railroad Still Buying

Philadelphia, June 27.—An inquiry for 15,000 tons of structural shapes from a Canadian builder who is figuring on the large Russian car order is before eastern mills. This business is not expected to be closed for several weeks. Some good-sized lots of ship shapes also are wanted for export, including 1,500 tons for Italy. New business in the domestic market is at a low ebb, as prospective buyers are holding off to see if the present prices are going to be sustained. The Pennsylvania railroad, however, seems to be going ahead with work at prevailing prices, for it offered 5,000 tons or more in new bridges the past week. Specifications against contracts with certain mills have dropped off. Buyers, however, have manifested their intention to draw out their second quarter tonnages in full, and a brisk volume of orders is expected before the week ends. There is less talk of 2.50c, Pittsburgh, being obtainable on early shapes. One Pennsylvania mill who was making this price now is asking 2.60c to 2.75c, Pittsburgh, these figures applying to certain sizes only. One eastern maker now is quoting 2.75c, mill, for shipment at its convenience.

Bids Rejected

New York, June 27.—Expectation of lower prices by the time this steel is required since the deliveries will run into 1918, has prompted the public service commission to reject all bids recently received on 52,000 tons of riveted and beam material for the completion of the remaining sections of subway and elevated railroad extensions in the metropolis. On this bidding, the American Bridge Co. was low on about 36,000 tons and the McClintic-Marshall Co. on about 16,000 tons. The American Bridge Co. was the low bidder on the entire tonnage on an alternate bid. One section involving 15,000 tons upon which general contract bids previously had been received, probably will be ordered ahead. The stream of small structural inquiries, particularly those for plant extensions upon which quick shipment is asked, continues, but there is an absence of orders or inquiries running into tonnages. The market presents a quiet appearance. Some fabricators continue to resell some of their plain material, due in part to the shortages and inefficiency of labor. The 3-cent Pittsburgh price on plain material practically has disappeared and the market is quoted at from 2.50c to 2.75c, Pittsburgh, or at from 2.669c to 2.919c, New York.

Shapes Hold Position

Pittsburgh, June 27.—Recent offerings of structural material at 2.50c for rather prompt delivery have failed to affect the general market for forward shipment, leading mills continuing to quote 2.50c for delivery at their convenience. No trace of that figure being shaded can be found and there is every reason to believe that it will continue to represent the bottom of the market until mills, now carrying enough tonnage to maintain present rates of operation four months and longer, are actually hungry for business. Specifications against contracts are not falling off to any appreciable extent, but new buying is comparatively light, for obvious reasons.

(*For complete prices see page* 1442.)

Church Building 16 Stories

Cleveland, June 28.—Plans are being drawn for a self-supporting institutional church, housed in a 16-story steel and white tile fireproof structure, costing at least $1,500,000 to be erected on the site occupied by the Euclid Avenue Baptist church at the southwest corner of Euclid avenue and East Eighteenth street, of which John D. Rockefeller is a member. About 5,000 tons of steel probably will be required.

Fifteen hundred or more trucks to be built by the Peerless Motor Car Co., for the United States government will require a considerable tonnage of 5 and 6-inch channels and mills have promised to give as early delivery as possible in order to hurry up the building of the trucks. The structural market in Cleveland is very quiet at the present time.

Structurals Move Better

Chicago, June 26—Lettings of structural material in the west during the past week are much more numerous than has been the case for a considerable time. No less than 11 projects involving 100 tons or more were closed.

The largest item is the material for the 160-inch plate mill at the Gary plant of the Illinois Steel Co., totaling 3,500 tons, which will be fabricated by the American Bridge Co. The Decatur Bridge Co. has taken 478 tons for a building at Peoria and the Pacific Rolling Mill Co. has taken 300 tons for a factory building for the Moore & Scott Iron Works, at Oakland, Cal.

CONTRACTS AWARDED.

Illinois Steel Co., 160-inch plate mill, Gary, Ind., 3,500 tons to American Bridge Co.

Lehman building, Peoria, Ill., 478 tons, to Decatur Bridge Co.

Moore & Scott Iron Works, factory building, Oakland, Cal., 300 tons, to Pacific Rolling Mill Co.

Dan Webster School, city and county of San Francisco, Cal., 227 tons to Webster Iron Works.

J. M. Patrick, theater building, Minneapolis, Minn., 217 tons.

Metropolitan West Side Elevated Railway Co., extensions of track over Canal street, Chicago, 200 tons.

Illinois Traction System, Peoria, Ill., self supporting steel stack, LaSalle, Ill., 124 tons, to Chicago Bridge & Iron Co.

A. T. & S. F. Railway, repairs to seven bridge spans, 112 tons, to American Bridge Co.

East St. Louis Cotton Oil Co., furnace and auxiliary buildings, East St. Louis, Ill., 111 tons, to Missouri Bridge & Iron Co.

M. A. Little, apartment building, San Francisco, Cal., 100 tons, to Ralston Iron Works.

Residence for E. T. Stotesbury, Chestnut Hill, Pa., 500 tons, to the Phoenix Bridge Co.

Commonwealth Edison Co., Cragin substa-

tion, Chicago, Ill., 105 tons, to Gage Structural Steel Co.

Bridge at Portland, Me., for Portland Terminal Co., 400 tons, to the American Bridge Co.

Settlement House, Barrow street, New York City, 350 tons, to Geo. A. Just.

Bridge work for the Norfolk & Western, 200 tons, to the American Bridge Co.

Miller Rubber Co., Akron, O., new factory building, 2,500 tons, to Forest City Steel & Iron Co.

Dodge Motor Car Co., Detroit, new foundry addition, 500 tons to Russel Wheel & Foundry Co., Cleveland.

CONTRACTS PENDING.

Twenty-four bridges for the Pennsylvania lines east, about 3,000 to 4,000 tons, bids being taken.

Meenan garage, Fifty-fifth street, New York City, 400 tons, bids being taken.

Loft building, 104th street and East river, New York City, 1,800 tons, bids being taken.

Apartment for the Candler Holding Co., Edgecombe avenue near 150th street, New York City, 500 to 600 tons, bids being taken.

Apartment hotel for the Gresham Realty Co., West Seventy-first street, New York City, 700 to 800 tons, bids being taken.

Besse department store, Springfield, Mass., 700 to 800 tons, bids being taken.

Filter house for Chesbrough Mfg. Co., Perth Amboy, N. J., 300 tons, bids being taken.

Titanium Alloy Mfg. Co., Niagara Falls, N. Y., plant extension, 200 tons, bids soon.

Mitchell, Parker & Brown, Buffalo, stores and office building, 200 tons, Colson & Hudson, Buffalo, architects. Taking bids.

New York State Erie Barge Canal, Terminal contract 52, at Pier 6, New York City; state superintendent public works taking bids on 215 pounds structural, 16,500 pounds steel sheet piling, 8,900 pounds iron castings, 69,000 pounds metal reinforcing material.

Hotel, Harrisburg, Pa., 300 tons, bids being taken.

Factory building, Clarksburg, W. Va., 1,200 tons, and factory building at Glassboro, N. J., 1,800 tons, Wynkoop & Gormley, Toledo, O., architects.

Bridge work for the Southern railroad, 250 tons, bids being taken.

Bridge work for the New Haven, 200 tons, bids being taken.

Electrical Engineers' Meeting

More than 200 men of the electrical engineering profession are attending the thirty-third annual convention of the American Institute of Electrical Engineers in Cleveland, this week. A paper read at the Tuesday morning session, on Electric Drive of Reversing Rolling Mills, which will be published in part in an early issue of *The Iron Trade Review*, is of particular interest to mill owners and operators. Many features of entertainment were provided for the delegates during their stay in Cleveland.

Death of Harry F. Thayer

Harry F. Thayer, for many years a well-known salesman of the Carnegie Steel Co., at St. Louis and New Orleans, and in recent years of the United States Steel Products Co., at Los Angeles, died in Los Angeles, June 21, aged about 65 years. The burial was at St. Louis. Mr. Thayer was regarded as a steel salesman of rare ability.

Tunnel Needs

River Tunnel Construction Will Call for Large Tonnage

New York, June 26.—Another large cast iron segment contract for river tunnel construction in this territory will come up for action July 13, when bids will be taken by the city for the construction of a tube for rapid transit purposes under the East river at Sixtieth street. It is estimated this will require from 30,000 to 40,000 tons of segments. There also is talk of a new tube from the Battery under the Hudson river to Communipaw, N. J., and a company has been incorporated to handle this proposition. The cast iron pipe market remains very quiet on the side of public lettings. Private buying, however, holds up. The Eastman Kodak Co. has awarded several thousand tons of 20's and 24's to the Warren Foundry & Machine Co. against a recent inquiry for about 7,500 tons and still is to act on the 42-inch on which it is undecided whether iron or steel will be used. Santos, Brazil, is figuring on 500 to 600 tons additinal. Prices are holding more uniform.

J. B. Kessler, general agent of the Carnegie Steel Co., Pittsburgh, has returned to that city after an absence of several months on the Pacific coast.

Responding to Their Country's Call

FULL PAY during their absence from their regular duties will be given all employes of the various subsidiaries of the United States Steel Corporation who are entering into miliary service of the United States government at present in view of the Mexican crisis. Advice to this effect has been given by the officials of the various subsidiary companies to those men in their employ who already are in the military service and to those who now are contemplating enlisting. As long as they remain in the military service of the country, their present salaries or wages will be continued until otherwise ordered. At the conclusion of the present trouble, the jobs of these men will be restored to them as far as possible under the business conditions that then shall prevail. Independent iron and steel makers are adopting policies with regard to the military service of their employes, which are similar to that of the Steel Corporation. Among those in the east which officially have made known this intention are the Bethlehem Steel Co., the Carpenter Steel Co., and others.

Practically all metal-working and metal-producing companies have joined freely in the movement to take care of their men who are serving in their respective regiments. With some companies, full pay will be continued indefinitely; with others, where families are involved, the latter will be looked after fully. In most cases, the men are assured they will be reinstated in their former positions when the present trouble is over. Some companies have announced that the plan of paying full salaries and of holding open positions, will be continued, if necessary until Jan. 1, 1917. If circumstances then demand, a further announcement will be made.

Ford is Different

In the line with his pacifist policies Henry Ford has announced that any employes of the Ford Motor Co. who are members of the Michigan national guard will not only not receive pay while absent, but will forfeit their places as well.

At the offices of Mr. Ford information as to how many militiamen were included in his 20,000 odd employes in Detroit was refused.

"We would be sorry to see any of our men resign to enlist in the guard," one of Mr. Ford's assistants said, "but both recruits and state militiamen will be treated alike—as though they quit the plant to engage in other lines of business."

(*For complete prices see page* 1442.)

Testing Society

Committee Reports Receive Attention of Delegates at Opening Sessions

Atlantic City, June 27. (By wire.)—Measured by today's registration, the attendance at the nineteenth annual meeting of the American Society for Testing Materials, which opened at the Hotel Traymore on Tuesday, will set a new high record. Nine technical sessions, terminating Friday afternoon, have been provided and a total of 53 topics is on the program for discussion. Two sessions will be devoted exclusively to the consideration of steel and iron and non-ferrous metals. The report of the committee on steel constitutes a volume of 100 pages. Seventeen standard specifications will be presented for revision, seven for adoption and the proposed new specifications, include standards for track spikes, screw spikes, tie plates, carbon steel bars for railway springs with special silicon requirements, eliptical springs for automobiles and boiler and fire box steel for stationary service.

At the opening session S. V. Hunnings presented the report of the committee on wrought iron. The work of this committee during the past year, with the exception of an extensive series of tension and vibratory tests of staybolt iron, has been confined to tubes and pipe. Changes in the table of standard minimum weights in the standard specifications for lap-welded iron boiler tubes were adopted, since the present table is incorrect in that the different thicknesses, as expressed in decimals of an inch, do not conform exactly to the respective gage numbers, but to the gage number corresponding closest to that particular thickness. The revised table harmonizes with the table included in the standard specifications for steel tubes, but the weights of the tubes are 2 per cent less than the weights of the steel tubes for the corresponding diameters and gages. The committee also recommended that the title of the present standard specifications for lap-welded iron boiler tubes be changed to "Lap-welded Charcoal Iron Boiler Tubes, Boiler Flues, Safe Ends and Arch Flues for Locomotives" and that the table of standard minimum weights be extended to include all sizes and gages ordinarily used in locomotive practice. The tentative methods for laboratory sampling and analysis of coal reported last year were referred to letter ballot for adoption. A proposed standard method for sampling coal was presented.

The committee on preservative coatings for structural materials outlined a series of tests which involve the painting of steel plates, after various methods of preparation, and their subsequent exposure at Altoona, Pa., and Brooklyn, N. Y. The methods of conducting this investigation were outlined in great detail and considerable interest was manifested in the results that are to be obtained.

"The Work of Committees" was the subject of the annual address by Mansfield Merriman, president of the society. Of interest to iron and steel manufacturers was a paper by Henry M. Howe and Arthur G. Leby, entitled "Tests on the Hardening and Tempering of Eutectoid Carbon Steel and on the Shore Test," and A. V. deForest discussed "Some Experiments on the Plastic Elongation of Wire."

The membership of the society is now 2,071. At last year's meeting the enrollment was 1842.

Officers for the ensuing year were elected as follows: President, A. A. Stevenson, vice president, Standard Steel Works, Philadelphia; vice president, S. S. Voorhees, engineer chemist, bureau of standards, Washington, D. C.

Members of the executive committee: W. H. Bassett, American Brass Co., Waterbury, Conn.; John Brunner, Illinois Steel Co., Chicago; G. W. Thompson, National Lead Co., New York, and F. E. Turneaure, University of Wisconsin, Madison, Wis.

A Clear Note from the South

By J. B. Carrington

President, Woodstock Iron & Steel Corporation, Anniston, Ala.

THE question of "Preparedness and Efficiency" to meet eventualities is uppermost in the minds of the business men and manufacturers at this time. The same should be applied to our government, and nothing will insure peace and prosperity to America better, or more permanently, than applying the same principles for the call of our country that would be applied by an executive of a manufacturing concern, and it is the duty of every manufacturer to heed and encourage the sentiments expressed by President Wilson, in his speech on Memorial Day at Arlington cemetery.

Bright and Snappy.—The *Lifter* is a bright, snappy little family paper whose publication has just been started by Rogers, Brown & Co., Cincinnati. A feature of the first number is the leading article, "Greetings to the *Lifter*," by D. B. Meacham, in characteristic style, its solid common sense being tinged with humor.

Spot Benzol

Is Strong, with Offerings Scarce—Contracts for Sulphate of Ammonia

New York, June 26.—Fertilizer manufacturers now are placing yearly contracts for sulphate of ammonia, the prices having been fixed at a range of $3.25 to $3.35, per 100 pounds at tidewater. The movement is in its incipiency and only a limited number of contracts yet have been taken, but it is expected that bookings will come along briskly during the next few weeks. The season's prices compare with about $3 a year ago, which was determined before the rise in the market was under way.

The spot benzol market continues strong, as offerings are scarce and sellers could dispose of considerable quantities, if they could obtain them. Few contracts for forward delivery are being made. There is a continuing good inquiry for toluol from makers of explosives, the closing of which is dependent upon the taking of new contracts for the latter. These matters, accordingly, still are in a tentative stage. The market for both spot and contract is steady at the quoted prices. There have been more liberal offerings of solvent naphtha by makers, but these have been absorbed readily by the present market at current prices.

The current quotations per gallon at the maker's plant on leading coke oven by-products, are as follows:

Pure benzol, spot	$0.75
Pure benzol, contract	.70
Toluol, spot	4.50 to 4.75
Toluol, contract	4.50
Solvent naptha, spot	.45 to .50
Solvent naptha, contract	.40 to .45

Sulphate of ammonia is $3.25 to $3.35 per 100 pounds at tidewater for both spot and contract.

Appointed Sales Agent

The Goldschmidt Thermit Co., 120 Broadway, New York City, has been appointed sales agent for the Keokuk Electro-Metals Co., Keokuk, Ia., which is installing a new electric furnace plant for the manufacture of 50 per cent ferro-silicon. The annual production of this plant is rated at 2,000 to 3,000 tons. The officers of the Keokuk Electro-Metals Co. also are officers of the Otis Elevator Co. The Goldschmidt Thermit Co. now is located in its new suite of offices in the Equitable building 120 Broadway. Its offices previously were at 90 West street.

The National Steel Casting Co., New Cumberland, W. Va., expects to complete its new plant at an early date. A 20-ton open-hearth furnace will be in operation about July 1.

MEN OF THE IRON TRADE

Who they are Where they are What they are doing

ARCHIBALD A. STEVENSON, recently elected president of the American Society for Testing Materials, is one of the leaders of the technical branch of the steel industry. At the present time, he is vice president of the Standard Steel Works Co., Burnham, Pa., a position to which he was elected in July, 1908. He has been president and vice president of the Association of American Steel Manufacturers and is a member of the American Society of Mechanical Engineers, American Institute of Mining Engineers, the International Association for Testing Materials, the Franklin Institute of Philadelphia, the Western Railway Club, of Chicago, and of various clubs in his home city, Philadelphia.

He was born in Allegheny City, Pa., April 10, 1862. He received his scholastic education in the high school at Rock Island, Ill., graduating in 1878. Subsequently, he attended the University of Illinois for two years. In 1881 he entered the employ of the Southwark Foundry & Machine Co., Philadelphia, where he remained for four years and a half. During the last year he served as foreman of the drawing room. He became connected with the Cambria Iron Co. in 1886, originally in the chief engineer's office and later as foreman of the forge and axle department. His first affiliation with the Standard Steel Works Co. was in 1888 as an engineer. Later he filled various positions of increasing responsibility until Jan. 1, 1903, when he was made superintendent. His election as vice president of the company took place in July, 1908. Mr. Stevenson's business address is Morris building, Philadelphia, and his residence is at Ardmore, Pa.

C. L. Taylor, chief engineer of the Morgan Engineering Co., Alliance, O., after a trip of about two months in Russia, returned from Liverpool on the ADRIATIC, June 23.

Sir John Eaton, of Toronto, Huntley Drummond, of Montreal and W. J. Christie, of Winnipeg, have been appointed directors representing the Canadian government on the board of the Canadian Northern Railway.

Isaac H. Levin, 186 Hillside avenue, Newark, N. J., has resigned as chief engineer and chemist of the International Oxygen Co. in order to devote his time to chemical research and as a specialist in the electrolytic field.

George T. Snyder, formerly chief engineer at the National works of the National Tube Co., McKeesport, Pa., recently was transferred to the works at Lorain, O., in a similar capacity. A. L. Hoerr has been appointed to succeed Mr. Snyder as chief engineer at McKeesport. F. W. Waterman, formerly chief engineer at the Lorain works, is manager of the new tube

ARCHIBALD A. STEVENSON

mills of the company, being erected at Gary, Ind.

Rev. Samuel E. Dunham, pastor of the Buckingham, Conn., Congregational church, has resigned and entered the employ of the Colt's Patent Firearms Mfg. Co., Hartford, Conn., working at the bench filing rifles to be used by the allies on the battlefields of Europe.

Harrison Prindle, formerly of the Iroquois Iron Co., Chicago, has been made general manager of the Lebanon Blast Furnace Co., which will put in operation about July 1 the Meily furnace at Lebanon, Pa., for the manufacture of ferro-manganese and spiegeleisen. E. G. Rust is president of the company and G. E. Meily, secretary and treasurer.

Frank H. Johnson, 208 South La Salle street, Chicago, has been appointed western sales manager for the Hess Steel Corporation of Baltimore, handling all sales west of Pittsburgh. The finishing mills and additional electric furnaces will be ready for operation about July 1, and when the entire plant as under construction now is completed, this will be one of the largest single, independent producers of electric steel in this country.

C. C. Kidd, who has been connected with the American Steel & Wire Co.'s Cleveland office for the past 12 years, has resigned to accept a position with the Carola Co., Cleveland, manufacturer of phonographs.

C. W. Stettinius, of J. P. Morgan & Co., who has charge of the contracts in this country for the allied governments, left on the American liner, ST. LOUIS, June 24, to confer with British and French officials in London and Paris.

John F. Tinsley, for seven years superintendent of the south works of the American Steel & Wire Co., Worcester, Mass., has resigned and accepted the position of assistant general superintendent of the Crompton & Knowles looms in the same city. He will be succeeded by John Wheeldon, superintendent of the Cuyahoga works, Cleveland, who was formerly superintendent of the north works in Worcester, Mass. He was transferred to Cleveland in July, 1911. The changes take effect at the end of the month.

William A. Parent has resigned his position as general manager of the Edward Darby & Sons Co., Camden, N. J., in order to become general manager of the Dexter Metal Mfg. Co., which recently took over the plant and business of Merritt & Co., Camden, N. J. The Dexter Metal Mfg. Co. manufactures steel lockers, shelving, wire guards, ornamental brass and iron work, etc. Previous to making his new connection with the Dexter company, Mr. Parent was associated with the Darby company for 34 years.

Gilbert Rigg, one of the world's foremost zinc experts and for a number of years chief metallurgist of the New Jersey Zinc Co., has resigned this connection to become associated with the Broken Hill Associated Smelters Proprietary, Ltd., Australia, as consulting metallurgist.

Ore Movement

Is Very Heavy—Some Underground Mines Are Still Idle

Cleveland, June 27.—The iron ore movement continues at a record-breaking rate and the statistics for June are looked forward to with confident expectation that they will show a movement of more than 9,000,000 tons. Chartering is light at $1 from the head of the lakes, 90 cents from Marquette and 70 cents from Escanaba.

A number of underground mines on the Mesabi are idle on account of strikes and the situation continues to cause anxiety, but operations have not been interfered with at the open pit mines. There is overwhelming evidence that a very large percentage of the miners do not want to go on strike, but some allow themselves to be intimidated by the threats of the "I Won't Work" agitators.

Failed to Agree

As briefly reported by *The Iron Trade Review*, last week, the wage scales affecting sheet and tin plate mills controlled by the Amalgamated Association of Iron, Steel and Tin Workers for the year beginning July 1, next, were signed June 19, at Atlantic City. Officers of the association and manufacturers of bar iron were unable to reach an agreement as to wages for the year beginning July 1, at a conference which followed that at which the sheet and tin plate mill scales were signed. Bar iron mill scales will again be considered at another conference, the date of which has not yet been determined.

Details of the sheet and tin plate mill scales were announced in these columns a week ago. It develops, however, that advances in pay range from 3 to 4 per cent, instead of from 4 to 5 per cent, as reported last week.

Gary Will Sail

New York, June 28. (By wire.)—Judge Gary sails from Vancouver, July 13, to spend several months in Japan, China and the Philippine islands.

Coke is Stronger

Pittsburgh, June 28. (By wire.)—The market for Connellsville coke for prompt delivery has been active the last few days and fuel has been selling at prices slightly above those previously prevailing. One dealer this week has sold about 10,000 tons of furnace coke for immediate delivery at $2.65, ovens. The market is quotable at a range of $2.60 to $2.65, ovens, for spot delivery.

Trading in Specialties

New York, June 27.—Trading in specialties is practically the only activity in the old material market, and as the regular grades are neglected, the situation shows no improvement. Dealers have few orders left to cover and buying from that source is unimportant. Prices still are heavy with a downward tendency. There continues some local demand for steel axles and exporters also are in the market for good tonnages of the same grade for which they will pay up to $31, New York.

The Non-Ferrous Metals

Copper Lead Spelter Tin

DURING the past week, further price concessions were made in the copper market by second hands in a vain attempt to attract buyers, but producers continue to hold firm. Indicating the confidence of first hands in the strength of the market is the statement that the Anaconda Copper Mining Co. has refused to contract its output to the end of the present year at 29 cents a pound. However, it is generally conceded that this price can be done without difficulty for last quarter shipment.

As the producers are virtually sold up to this period, their attitude toward the present situation can be readily understood, especially in view of the fact that second hands have only nearby copper to offer. Reports of further foreign inquiries continue to be heard, but as yet it appears that no action has been taken. In the meantime, the visible supply of copper in Europe continues to decrease and it is thought that France and Russia, which recently negotiated large loans in the country for war material, will be calling for good-sized tonnages within the next couple of months. There are also indications that Great Britain again will be in the market shortly. At present, domestic consumers appear to be covered fairly well on their immediate needs. However, consumption in this country continues unabated, and it is expected that, with the resumption of foreign buying, domestic demand again will assume good proportions.

The present crisis between this country and Mexico is being viewed by the copper trade with particular interest, and in the event of war it is thought the effect upon production will prove serious. Already the suspension of operations at the Greene Cananea and Phelps Dodge properties, if reports be accurate, are reducing the monthly output approximately 10,000,000 pounds, and the possibility of hundreds of Mexican laborers leaving the copper mines in Arizona and New Mexico is being regarded with no little concern.

(*For complete prices see page* 1442.)

The New York Market

New York, June 27.—A downward tendency in prices, on an exceedingly small volume of business, characterized most of the metal markets during the week ending today. The lead market the latter part of last week was featured by a flurry due to large foreign tonnages on which producers were figuring. A comparatively small proportion of this business, however, was placed here. The outside market now is quoted at 6.62½c to 6.70c, St. Louis, and 6.80c to 6.90c, New York. The American Smelting & Refining Co. continues to quote 7c, New York, and 6.92½c, St. Louis.

The antimony market has been featured by a marked improvement in demand. This has involved chiefly spot which is being sold on the basis of 18.37½c to 18.50c. New York, but there also has been a decided improvement in the inquiries for futures and some good future tonnages have been placed.

The aluminum market is slightly easier but is by no means weak. No. 1 virgin in the outside market is quoted at 63c to 64c for spot shipment in carload lots. No. 1 remelted is quoted at 61c to 63c and No. 12 alloy at 48c to 50c.

The copper market has been featured by continued offerings originating with consumers who bought more copper than they needed on the last buying movement. The outside market on electrolytic is quoted at 26.50c to 27c, cash, for June shipment, while July, August, September and October may be quoted at 26c to 26.50c, cash. Ordinary lake copper for prompt shipment may be quoted at 26.50c to 27c, cash and ordinary casting copper at 24c to 24.25c, cash.

The spelter market is exceedingly dull and weak. Prime western is quoted as follows: June, 11.50c to 11.75c, St. Louis; July, 11.25c to 11.50c; August, 10.75c to 11c; September, 10.25c to 10.50c; fourth quarter, 9.50c to 9.75c. Ordinary brass special spelter for prompt shipment is quoted at 13.50c to 13.75c, St. Louis.

The tin market continues to sag off. Some good buying has featured the week but the market has not been active. Spot now is quoted at 39c while ex-steamer prices are about as follows: July, 38.75c to 38.87½c; August, 38.62½c to 38.75c; September, 38.50c; last quarter, 38.25c.

Electric Power in Southern Mines

THE ABUNDANCE of natural water power in the South has enabled the industries to solve the power question most satisfactorily. The several hydro-electric plants in the Birmingham district furnish power to several mines. The reliability of the service and the rugged equipment are rapidly winning favor

IN THE operation of iron mines in the south, as in the Lake Superior district, the question of power cost is constantly becoming more important owing to the steady increase in the size of plant necessary to mine ore successfully. The economy of electrical energy over steam already has been demonstrated, and as there is plenty of cheap hydro-electric power available in the Birmingham district, it is not surprising that the use of electricity for the operation of mining equipment is making rapid progress in spite of comparatively low prices for coal.

Up to date, the Tennessee Coal, Iron & Railroad Co., Birmingham, Ala., a subsidiary of the United States Steel Corporation, has been responsible for practically all of the development in the application of electricity to mining operations in the south. The latest installation to be placed in operation by this company is at Muscoda No. 4 property in the Red mountain district, southwest of Birmingham. At this point a large electrically operated hoist and extensive electrically - driven, air - compressor equipment have been provided, superseding steam driven apparatus. The mine shaft, or slope, as it is usually called in the south, pierces the side of the mountain at 22 degrees or 40 per cent. The ore is hauled out in a skip, or car, running on a 5-foot gage track laid down the slope. Only one track is provided and the operation, therefore, is unbalanced. The maximum length of haul is 3,208 feet and the skip, which weighs 13,440 pounds, carries 26,880 pounds of ore per trip. The total load, therefore, is 40,320 pounds, or practically 20 net tons, not including the weight of the rope. This load is handled through a reduction gear, by an 1,800-horsepower, 3-phase, 60-cycle motor, said by the builder, General Electric Co., Schenectady, N. Y., to be more than twice as large as any other alternating-current hoist motor in the United States.

The motor operates at 356 revolutions per minute under full load and the rope is wound on a drum 12 feet in diameter at the rate of 2,700 feet per minute. The no-load speed of the motor is 360 revolutions per minute. The speed of the drum is 71.5 revolutions per minute.

Only 15 seconds are allowed for acceleration, eight seconds for retardation and 30 seconds for rest while the skip is being loaded. The hoist is designed to operate from a depth of 5,280 feet. When in operation at this depth, the motor runs at constant speed for 106 seconds. The skip makes a maximum of 12½ round trips per hour, the hoist being designed for maximum capacity of 150 gross tons per hour, with an average capacity of 100 tons per hour.

The reversible control equipment includes a primary reversing contactor panel with mechanically and electrically interlocked, magnetically operated triple-pole air-brake contactors supplemented by a secondary control consisting of a General Electric No. 3 liquid rheostat complete with a 4-inch pump and 5-horsepower, 220-volt motor.

The power is transmitted from the motor to the hoisting drum through a Wuest herringbone gear set manufactured by the Falk Co., Milwaukee, Wis. The gears run in an oil bath and the gear reduction is 5 to 1.

The electrically driven air-compressor equipment includes two 4,200-foot Nordberg compressors direct-connected to 700-horsepower, 148-ampere, 3-phase General Electric constant speed motors. The motors op-

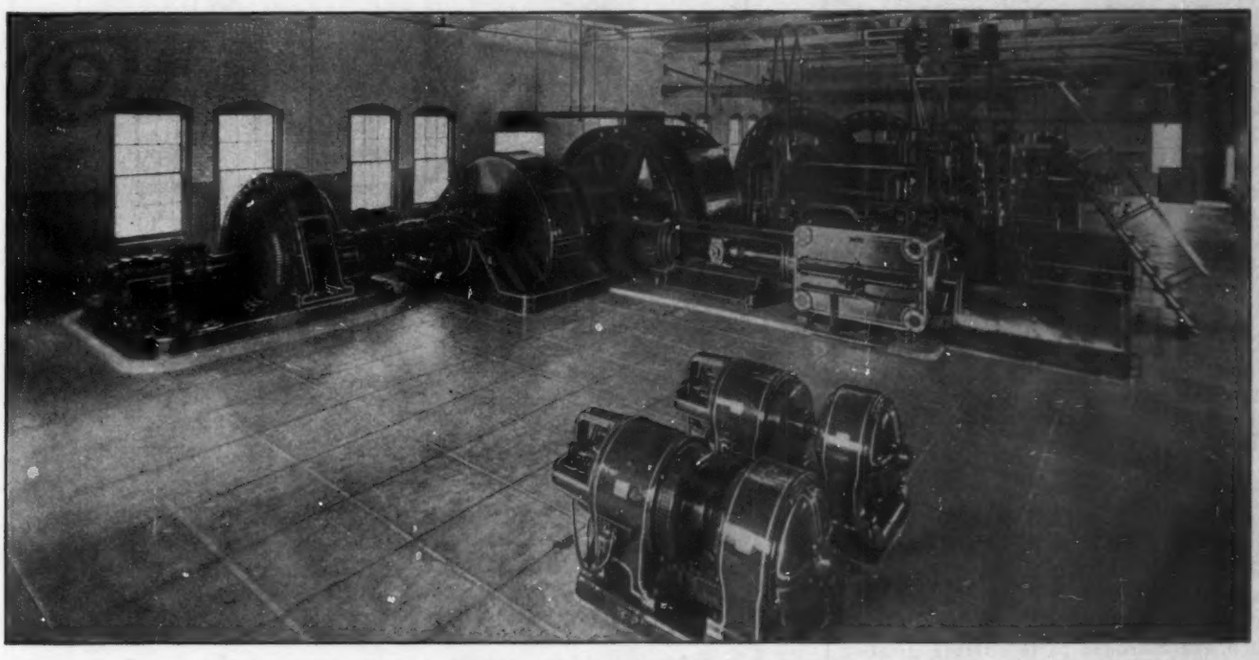


FIG. 1—ALTERNATING CURRENT, 1,800-HORSEPOWER MINE HOIST AT MUSCODA MINES, ALABAMA. THE HOIST MOTOR IS SHOWN AT THE EXTREME LEFT. THE REDUCTION GEAR IS BETWEEN IT AND THE STEAM ENGINE, WHICH IS DISCONNECTED

FIG. 2—1,500-GALLON DUPLEX PLUNGER ELECTRICALLY DRIVEN PUMP INSTALLED AT MUSCODA MINE NO. 4

erate at 80 revolutions per minute and each unit delivers air at 80 pounds per square inch pressure. The compressors formerly were driven by steam and in changing over to electric drive, the steam cylinders have been removed.

The power, which is purchased from the Alabama Power Co. Birmingham, is delivered to the plant at 44,000 volts, 3-phase, 60-cycles. Duplicate transmission lines are provided. Before being delivered to the motors the power is stepped down to 2,200 volts by means of transformers.

New Charging Bell

Julian Kennedy, engineer, Pittsburgh, recently patented a charging bell for blast furnaces. The device is designed to guide and control the charge, thus promoting better distribution in the furnace. The problem of correctly distributing the raw materials in the blast furnace has lately attracted a great deal of attention and was the subject of a paper presented by George W. Vreeland at the New York meeting of the American Iron and Steel Institute. This paper was published in its entirety in immediately preceding issues of *The Iron Trade Review*.

Wet Stock Makes Trouble

Some of the difficulties experienced in securing uniform distribution arise from wet stock which will not slide as readily as dry material, from corrosion of portions of the top of the bell, the corroded parts offering greater resistance to passage of the stock, or from a lateral movement of the bell which throws the stock to one isde where its remains.

The details of Mr. Kennedy's invention are clearly shown in the accompanying illustration. Fig. 3 is a vertical section through one from of the bell, and through the feed hopper of a blast furnace. A modified form of the bell is shown in Fig. 1. Fig. 2 is a perspective view of the guides shown in Fig. 1. Fig. 4 is a vertical section through the top of a blast furnace, another form of guides being connected to the bell.

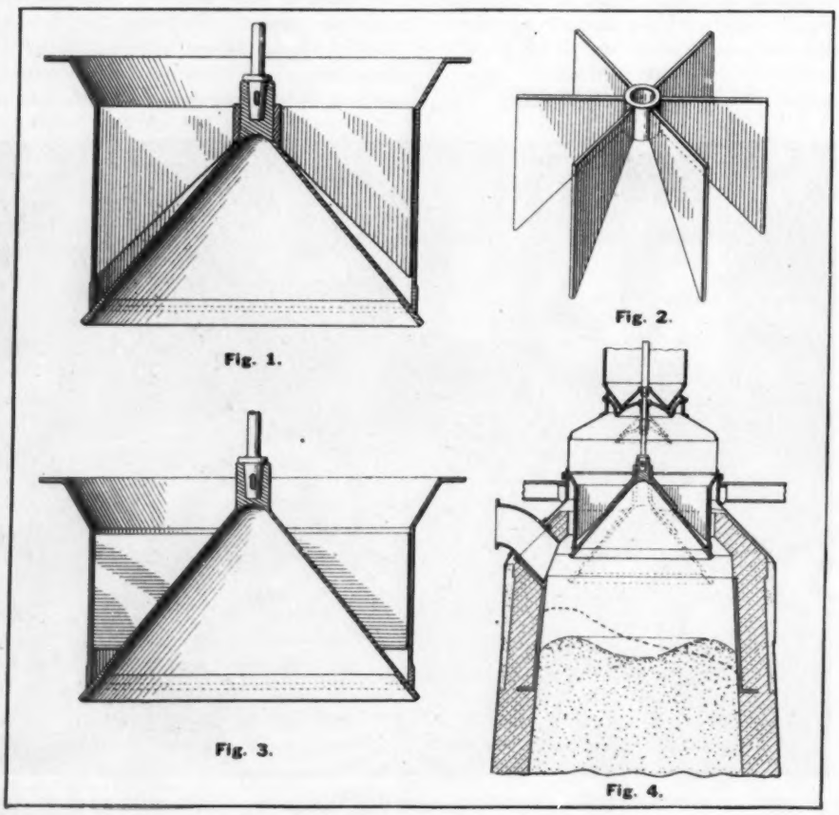
Wings Guide Stock

The guides or wings shown in Fig. 2 are claimed to insure protection from the difficulties mentioned. The guides which are shown in Figs. 1 and 2 are cast integral with the central hub.

They can be rotated about the boss of the bell, thus shifting the wings so that unequal wear of the top of the bell is prevented. The stock passes between these wings, thus being guided as it falls into the furnace. The guides are also designed to retain the bell centrally within the hopper. In the design shown in Fig. 1, the wings do not contact with the upper surface of the bell, so that portions of the stock commingle between the bell and the lower portion of the guides.

In the design shown in Fig. 3, the wings do not extend to the outer edge of the bell, permitting the stock to commingle before falling into the furnace.

Fig. 4 also shows the distribution which, according to Mr. Kennedy, results from the use of the device. The dotted line shows the irregular level of the materials in the furnace, which frequently occurs with present practice.



DETAILS OF NEW CHARGING BELL

Handling the Blast Furnace Charge

IN DISCUSSING the important question of properly distributing the raw materials of the blast furnace charge, the author points out the important part which the errors, either in the design of the furnace or in operating practice, may have in nullifying or partially defeating good distributing methods

BY ARTHUR J. BOYNTON

I WISH to base my discussion of Mr. Vreeland's practical and interesting paper on three of his statements, as follows:

The equations of the blast furnace have so many variable and so few constants that almost any one can solve the equation for the particular variable for which he is looking and apparently prove it to be correct.

A top can be built that will do good work; but, as a general proposition, the most successful double-bell tops, of which we have numerous examples in this country, are the result of continual alterations and changes over a number of years. The weak points are noted and eliminated as opportunity affords, until the materials are distributed correctly on the bell.

A rotating top is a most desirable refinement, but it is not a cure for all the "ills and ails" to which a blast furnace is subject. It will go far, however, toward ironing out and smoothing over some of the troubles of poor distribution, and leave the operator's mind comparatively free to take up other pressing questions which may confront him.

I have not time to discuss the matter of radial distribution below the main bell further than to say that definite and positive knowledge as to what this should be, and why, from the nature of the case, is almost impossible to obtain. The problem of circumferential distribution, as Mr. Vreeland defines it, although complex enough, can be scientifically solved much more easily, and I wish to speak of means of accomplishing this end.

Many Variables; Few Constants

Amplifying Mr. Vreeland's statement with regard to the tendency of all blast furnace men, and probably all other men, to solve an equation for a particular variable, especially when in trouble, I think it is true that the matter of distribution — that is, distribution about the main bell—has been complicated by the presence of other influences. Some of these influences are generally appreciated while there is one to which, so far as I know, little reference has been made.

Thus, the tendency of an insufficient number or insufficient area of downcomers has been generally supposed to cause enough loss of fine coke and fine ore at a point under the downcomers to cause hot working at these points.

The remedy for this condition, which consists in increasing the area of the furnace at the level of the offtakes, and increasing their number and area and their angle with the horizontal, is well understood and has been applied to many furnaces.

There existed, also, and still exists, the problem of what is called "wind distribution." To a considerable extent, this was only a resultant of bad stock distribution, since an overburdened or finely burdened section of the furnace will not take its due share of wind. Wind distribution, as Mr. Vreeland has said, is affected by plugging or reducing the size of certain tuyeres, which was formerly often done to prevent break-outs at the tapping hole. Stronger hearth jackets have largely prevented the necessity for this practice, excepting as a result of bad stock distribution.

Wind distribution is apparently little affected by the drop in pressure around the bustle-pipe. I have attached a differential gage to the bustle-pipe of a furnace immediately over the blast inlet and on the side opposite and have never found more than 0.2-inch of mercury difference in the static pressure.

Experiments which we have recently made with regard to the difference in temperature of blast in the tuyere stock immediately under the blast inlet and that opposite, in three different furnaces whose stoves are supplied with washed gas, showed a practically constant drop of nearly 50 degrees Fahr. from one side to the other. Just what the effect of such a constant difference in temperature may be is, like everything that goes on in the blast furnace, a matter of speculation.

I believe, however, that the hotter blast tends to premature melting, and to increased wind on the side next the blast inlet. If this difference happens to aggravate an error in stock distribution, the contour of the stock column is very possibly affected so that the hot side is low, with a tendency for coarse coke to remain close to the hot side, thus making the effect cumulative, in which case there will be very one-sided working and rapid destruction of the lining. The remedy for this condition lies in the use of insulating brick, for which there is apparently a more important reason here than at the hot-blast main or stoves, or possibly in the use of a tapered bustle-pipe, which will decrease the surface of the pipe relatively to the amount of air flowing. These pipes were formerly tapered by dust in the pipe, and the clear pipe following the advent of washed gas has doubtless increased the radiation, which high blast temperature also increases.

When all these variables existed to a greater degree than they now do, there grew up certain rules for locating downcomers, hot blast inlets, tapping holes and skip hoist with reference to each other about the circumference of the furnace. These rules were formulated by men of experience and good judgment, and were no doubt correct for the conditions as they existed locally and temporarily. They would not, however, apply where one variable was changed, consciously or unconsciously, and much grief was occasioned by borrowing a rule without sufficient understanding of the reasons for its existence.

So long, then, as these other variables exist, the problem of stock distribution is complicated by their presence, and a top developed, as Mr. Vreeland says by "continual altering and changing over a number of years," can only be correct with reference to all these variables as they exist, and is very possibly incorrect from the standpoint of distribution alone.

Distribution Problem Difficult

I wish to urge the importance of elimination of the other variables mentioned, in order that the study of the more complex matter of distribution may be done with more intelligence and more certainty, believing that so long as we are able to observe only the resultant of several inter-reacting causes, we have no sound basis for success.

The study of means of distribution cannot be carried to any very satisfactory conclusion by means of the small scale models mentioned by Mr. Vreeland. Certain of the grosser errors can be identified and corrected by this means, but a full-scale model is required for anything approaching accuracy. I have had the opportunity to study distribution with such a model

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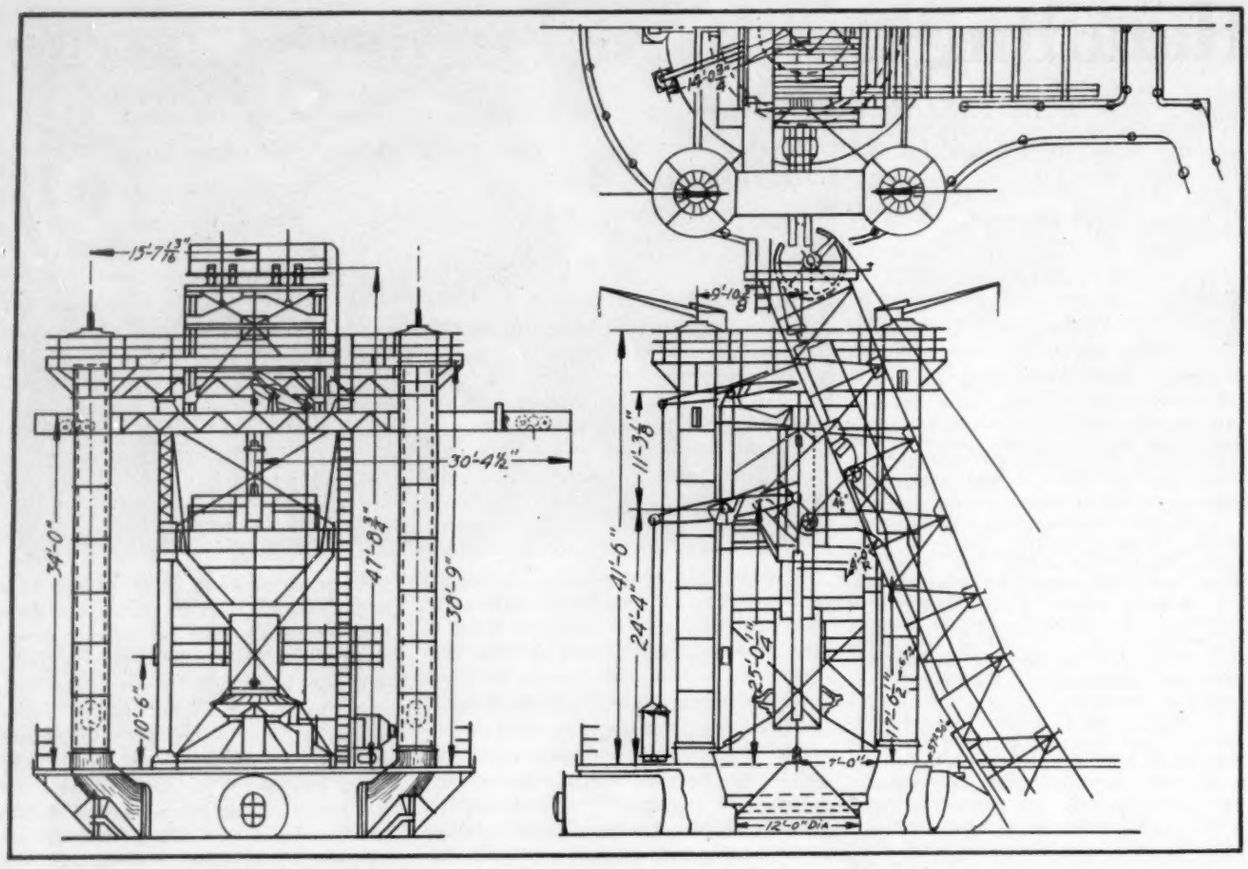
A discussion of the paper which George W. Vreeland presented at the New York meeting of the American Iron and Steel Institute, and which appeared in preceding issues of *The Iron Trade Review*. The author, Arthur J. Boynton, is superintendent of blast furnaces, National Tube Co., Lorain, O.



GENERAL ARRANGEMENT OF TOP ON LORAIN FURNACE NO. 2

and wish to state certain conclusions, as follows:

1.—Observations of bulk distribution on the main bell may seem practically correct when there is marked difference in weight and in segregation of coarse and fine material in the different quadrants, so much that no experiments on distribution are of much value without weighing and screening.

2.—Repetition of the experiments without change to the model showed practically constant results, so long as the character of the material did not change.

3.—Slight changes in the model produced very considerable effect on the distribution.

4.—A shape of receiving hopper which will be practically correct for ore alone, or for coke and stone alone, can be designed, but we were not able to design a hopper which was correct for both classes of materials, and the receiving hopper which resulted from these experiments was in the nature of a compromise.

5.—With any given receiving hopper the distribution is influenced by the angle, speed and path of dumping of the skip car, and especially by variations in moisture in the stock.

6.—Judging by the experimental distribution, and by the performance of the furnaces, marked segregation of fine coke and fine stone into one quadrant of the furnace will make this quadrant work colder than others more heavily burdened but free from this segregation.

After a series of campaigns under the top resulting from these experiments, we have installed the McKee revolving distributor on the three furnaces last out of blast, and I have been asked to amplify Mr. Vreeland's reference to this top.

As the name is generally used it has been somewhat confusing, because it has been applied not only to a complete design of top, but also to a peculiar method of rotation which can be applied to any standard double-bell top. It is of this system and method of rotation that I wish to speak, rather than of the details of design which apply to all double-bell tops.

Rotation of Top

As Mr. Vreeland has stated, the number of points and cycle of operations may vary, but the usual practice with this top is now to rotate through an angle of 60 degrees and multiples of this angle, and to handle a complete charge with each arc of rotation. The skip loads of material forming the first charge are successively dumped and held on the small bell and lowered onto the main bell with no rotation. The succeeding charge is handled in the same way, excepting that the throat of the furnace and the small bell are rotated 60 degrees after receiving each skip load and before it is dumped onto the main bell. The skip loads of the next charge are rotated through 120 degrees, and so on until the sixth charge, with each skip rotated through 300 degrees, completes the cycle.

The effect is as though the furnace itself were rotated, or as though the bin system and skip bridge were rotated about the furnace 60 degrees after each charge.

The scheme is based on the observed fact that most of the errors of distribution are constant in their tendency, if not in their extent, and that many which vary at different times are constant or nearly so at any given time.

Thus, the segregation of course and fine material due to a definite shape of bin and larry car will exhibit a constant tendency to appear at some one point in the furnace. The tendency may be more or less marked, according to moisture, frost, etc., in the stock, but its extent will be nearly the same at any given time. There will always be a tendency toward excess of one material or another at some point in the future, due to the shape of any given receiving hopper, which tendency may be greater

or less as it is influenced by the angle of dumping of the skip car. The length of the cables controling this angle may vary appreciably within 24 hours, but it is practically constant during any given cycle of operation.

This class of errors, therefore, can be largely corrected by a revolving top operating upon the principle described above.

The accompanying illustration shows a general view of the McKee distributor as applied to a furnace top at the Lorain works.

In addition, the installation includes a ball race at the top of the small bell tube and a magnetic control for automatic rotation. This control is located on the ground level, usually in the skip engine house, can be built for any number of points of distribution and skip loads per charge, and, as long as this cycle is followed, is entirely automatic. By throwing out the automatic control, hand control may be substituted. Rotation is started by contact made by a nut on a lead screw which revolves with the skip engine, contact being made when the engine reaches the end of its travel.

A dash pot in the system may be set to allow any required number of seconds to elapse between the completion of travel of the skip and the beginning of rotation, in order to clear the skip car of material before rotation starts. The skip car is free to run as in ordinary operation. Rotation is stopped by a limit switch geared to the drive on the top of the furnace, and by a magnetic brake on the motor shaft. Regulation of angle of revolution is practically correct. Five wires from the ground level to the top are required, three to the motor and two to the limit switch. The outside wiring is therefore very simple. The amount of attention required is that usually given to such switchboards, repairs are light and interruptions to service infrequent and of short duration. The drive and rotating parts require no attention except oiling. The ball races are arranged to clear themselves of dirt, and where cut steel gears are employed the wear is very slight. In our experience, therefore, the operation of the top presents no difficulties.

Conclusions

To the much-discussed question as to whether it is necessary and advisable to complicate furnace construction and operation by the installation of revolving tops, there are two answers: First, that mechanical and electrical progress, not only in building the rotating mechanism, but also the furnace itself, have made the complication almost inappreciably small; and second, that modern progress is not satisfied with any distribution short of the very best obtainable. The investigator who has gone through the costly and cumbersome experiments necessary to approximate good distribution in a stationary top is forced to admit that its limit is far from perfection, that his good distribution becomes poor distribution by a change from dry stock to wet, and that the variables due to weather and condition of stock which are most hopeless with a stationary top, are those which rotation easily corrects. The idea that stationary distribution is good enough will shortly disappear, unless it can be shown that distribution is better without rotation than with it, an argument which so far I have never heard.

Good distribution requires, therefore, in my opinion, first the elimination of other errors which may be confused with those of distribution; second, the development of a satisfactory top; and third, the refinement of the distribution thus obtained by rotation as described.

Handling the Blast Furnace Charge

BY H. S. BRAMAN

WE USE a Neeland top, which is practically the standard type except for one or two changes which we found it advisable to make in order to give somewhat better results. The small counterweighted bell which was used as a gas seal has been replaced by a box seal, this seal being an ordinary steel plate slide which is operated by an oil cylinder. The slide is pushed over the top opening of the furnace during the periods when the large bell is lowered and acts as a perfect seal in this position. The small counter-weighted bell often retained lumps of stock which would wedge between the bell itself and the seal, which of course would not give a perfect seal. Owing to the design of this bell it was necessary for it to travel in an arc which at one point only was centrally located in reference to the furnace. Even slight variations of this bell caused considerable unevenness in the stock distribution of the large bell. Any over or under travel of the bell in the bucket would consequently throw the small bell out of line and hence give uneven distribution. If the bucket, in being placed on top of the furnace, should vary its speed slightly the small bell would receive such a blow as to make it rebound with considerable force.

Another change was made to our layout when we adopted a parallelogram skip carriage which gave us a perfect line motion, keeping the bell rod in a vertical position during the entire travel of the skip and also during the dumping. A turn-buckle adjustment was incorporated in the design which gave absolute control over the placement of the bucket on top of the furnace and also allowed easy adjustment which would entirely correct any faulty distribution which might come from the wear and tear on the skip carriage.

Revolving Bucket

At the skip hole we have a rack which is worked by an hydraulic cylinder which turns the pinion on the bucket through 120 degrees each way, thus giving three points for dumping which aids considerably in distributing the coarse and fine materials. The operation of this turning is very simple. The bucket is first turned to the left through 120 degrees, then it is taken to the top of the furnace and discharged. The next bucket is turned to the right 120 degrees. The third operation requires no turning, thus giving a point between the first and second turning, which in all makes three points equally spaced.

No matter how much care is taken and how perfect the distribution on the large bell, it is quite possible to undo all the good efforts in the final distribution of the stock by having uneven surfaces on the stock line. Many different constructions have been used and some of the common ones are as follows: Cast-iron bricks, laid alternately with hard-burned bricks; hard-burned firebricks alone; cast-iron angles laid in firebricks; plain cast-iron wearing plates, and water cooled cast-iron wearing plates. Of the different constructions, we use the water-cooled cast-iron plates and find that in most cases the cast-iron plates outlive the furnace lining and hence give a surface which can absolutely be depended upon.

Poor coke, irregular ore, dirty limestone, etc., all have their effect on furnace operation and cannot be entirely overcome by perfect distribution or any one way of filling. We have found that after filling one way for some time, six weeks or so, that the furnace works sluggishly and somewhat irregularly, due no doubt to channelling of the gases, which has been directed by the filling and that certain portions of the charge

A discussion of the paper by George W. Vreeland which was presented at the recent meeting of the American Iron & Steel Institute and appeared in preceding issues of *The Iron Trade Review*. The author, H. S. Braman, is superintendent of blast furnaces and steel department, Youngstown Sheet & Tube Co., Youngstown, O.

become stagnant. At this time a change of filling will allow new channels to be formed and a general cleaning up is apparent.

Our standard method of filling is very much the same as that mentioned by Mr. Vreeland, and gives very good results for about six weeks, at the end of which we notice a certain degree of sluggishness in the working of the furnace. We then change the method of filling and after five days, or as soon as the cleaning up ceases somewhat, we again go back to the standard filling and find that the furnace travels with renewed activity.

Inspection Important

Inspection of our distribution on top by our operatives is another instance where the human element is quite as essential as a perfect automatic mechanism itself. Through the clean out and inspection doors on top of the furnaces our men are able to observe and measure stock distribution on top of the large bell. Occasionally sticky ores adhere to the bell and are not discharged upon lowering. Furnace rounds coming on top are therefore deflected in their course and unless frequent inspection trips are made, much trouble results.

In conclusion, therefore, I will say that we consider the distribution of raw materials in the blast furnaces as one of the most important phases in furnace practice and that accordingly we devote considerable time to what we think a proper execution.

Results With Slick Distributor

BY RALPH C. GLAZIER

IN Mr. Vreeland's paper the statement is made that "Faulty distribution increases the amount of flue dust more than any other cause." To minimize flue dust production it is necessary that the stock should settle in such a way as to permit a relatively uniform ascent of the gases. To accomplish this the charge of ore should be distributed in the furnace so as to avoid the formation of concentric rings and provide a large and regular number of porous portions, with a proper percentage of fines along the wall.

To obtain this distribution Edwin E. Slick, vice president and general manager of the Cambria Steel Co., designed and had installed on one of the blast furnaces at Johnstown, Pa., a distributing ring which was placed in the furnace top under the large bell. It proved so successful that the seven other furnaces were immediately similarly equipped.

Surrounding the main charging bell is a depending skirt formed of cast steel, the upper part of which is approximately cylindrical, while the lower portion has a number of depending fingers spaced apart, with their lower ends projecting inwardly. As the charging bell is lowered the stock slides down the surface of the bell and portions of it impinge against the distributor. Those portions which impinge upon the fingers are deflected toward the center of the furnace, while those which pass between the fingers continue in their travel outwardly toward the walls of the furnace and those which impinge against the upper portion of the skirt of the distributor drop more directly downward. In this way, the charge is deposited so as to form a large number of upright columns in the furnace, equal to the number of fingers and spaces in the distributor; these columns of stock are separated by the line of cleavage formed of the coarser portions of the charge which roll down each of the slight surface mounds.

Such an arrangement of stock permits a uniform ascent of the gases with the result that smelting irregularities are eliminated and a regular settling of the stock is accomplished. This insures the avoidance of operating difficulties by practically eliminating hanging and slips. The reduced velocity of the gas, due to its relatively uniform distribution through the stock column, minimizes the amount of friction and results in a decreased production of flue dust.

The actual production of flue dust since the installation of this distributor is less than half of that made formerly, and the amount of fine Mesabi ores which can be used is greater. For the same reason the blast pressures, top temperatures and coke consumption are lower with consequent further economies and ease of operation.

Prior to the use of the Slick distributor the charge consisted of more than 42 per cent of old range ores, in order to obviate, as far as possible, the slips and excessive production of flue dust. After the Slick distributor was installed, the old range ores were discontinued in certain cases and 100 per cent of fine materials were used, composing the iron bearing portion of the charge. This included 49. 8 per cent of miscellaneous fine grain Mesabi ores, 44 per cent of Mesabi Beaver ore, which is very fine, showing 15 per cent through a 100-mesh sieve, with other fines in proportion, together with 6.2 per cent of flue dust. Despite this fine mixture the flue dust production was more than cut in two.

The flue dust production on Cambria Steel Co.'s furnaces for the first four months of 1916 was 153 pounds per ton metal produced or about 3.6 per cent of the ore charged. The decreased amount of dust not only shows a marked saving in the yield of mixture but aids in the operation and lessens repairs and maintenance of stoves and boilers when unwashed gas is used. Briefly, then, the use of the Slick distributor has given smoother working furnaces and enabled the Cambria Steel Co. to use an increased percentage of Mesabi ores, while reducing the production of flue dust and decreasing the coke consumption. Patents have been applied for on the Slick distributor.

A discussion of a paper entitled "Handling the Blast Furnace Charge," read before the American Iron and Steel Institute by George W. Vreeland and published in *The Iron Trade Review*, June 1, 8 and 15. The author of this discussion, Ralph C. Glazier is with the Cambria Steel Co., Johnstown, Pa.

Use of Crucibles

Crucible makers have found difficulty in securing proper clays in sufficient quantity since the beginning of the war to supply the demand for high grade crucible. Although a good quality of domestic clays is being secured at the present time, the user of crucibles will find it advantageous to take certain precautions. Following are a few suggestions for the use and care of crucibles in foundries:

Greater care must be given in annealing — more time must be consumed after the crucible is received before it is put into service. In past years it has been customary for casters to carry a year's stock of crucibles ahead. Today, a crucible is put into service as soon as it is received.

The native clays now being used have made the crucibles more fragile than those made from the finer foreign clays—more likely to crack from sudden heating and cooling. For this reason, it is essential that the melters use more than usual care in handling the American-made crucibles. A good plan is to allow the crucible to cool in the furnace from which the coal has been removed.

Experience has proved that a greater number of heats may be secured from small crucibles, therefore, greater satisfaction will result if a crucible a size or two smaller than the one generally used is adopted. For example, if a foundry uses a No. 400 pot, it should adopt a No. 300 or a No. 225.

Properties of Ladle Test Ingots

IN ORDER to decide upon satisfactory types of test ingots a number of different kinds were examined for soundness and segregation. Blowholes in the ingots were responsible for analytical errors in the chemical test for segregation. Conclusive results can best be obtained from an examination of sound ingots

BY J. R. CAIN AND H. S. RAWDON

THE great diversity in the shapes and sizes of test ingots in current use by steel manufacturers has created a need for standardization. It has been felt that if it were possible to recommend satisfactory standard types of test ingots, manufacturers would soon recognize the benefits to be derived from the use of such types.

As a preliminary step to an investigation of the subject, inquiries were addressed to a number of steel manufacturers, asking them to state the size and shape of test ingots used in their plants, the number of test ingots per heat and time when poured, place and size of drill holes bored in obtaining drillings for analysis, and the size and shape of the ingot molds. The answers to the inquiries showed that the types shown in Fig. 1 are in general use in American steel plants. In order to investigate the properties of the various types it was decided to make a metallographic study of split ingots for soundness and segregation, and a chemical study of segregation on a companion set of ingots. The ingots were obtained from 17 different firms and were submitted in accordance with instructions, which called for four ingots from each of four grades of basic, open-hearth steel. The grading was made according to the carbon content of the steel, which ranged from 0.20 per cent to 1.00 per cent. Ingots of the 0.70 and 1.00 carbon content were to be annealed, and under no conditions were additions such as aluminum, silicon, ferro-alloys, etc., to be made at or after pouring the test ingots. The instructions also directed that one ingot from each grade be sawed longitudinally in halves. The ladle analysis for the heat from which the test ingots were poured was also required.

A microscope examination was also made of the cut faces of sections taken along a medial plane, the aim being to show the number, distribution, and relative size of blow holes and gas cavities. In Table I are given the results of the examination of a series of about one-third the total number which were chosen at random, split on a plane one-third the distance of the height from the bottom of the ingot except in tall narrow forms in which a medial section was used, the holes being counted in the cut section and their character noted.

The sulphur usually occurs in steel in the form of inclusions of manganese sulphide. By the use of photographic paper which has been soaked in dilute acid, the distribution of these sulphide specks in any section of the ingot can be recorded on the paper by the action of the hydrogen sulphide set free by the acid when the paper is pressed against the polished section. All of the metalloids in the steel segregate under similar conditions, though not nesessarily to the same extent, so that the sulphur print may be taken as an index of the distribution of the other important elements of the steel. It should however be borne in mind that the sulphur print is only a segregation map and that all quantitative results are only estimates based on the difference of tint

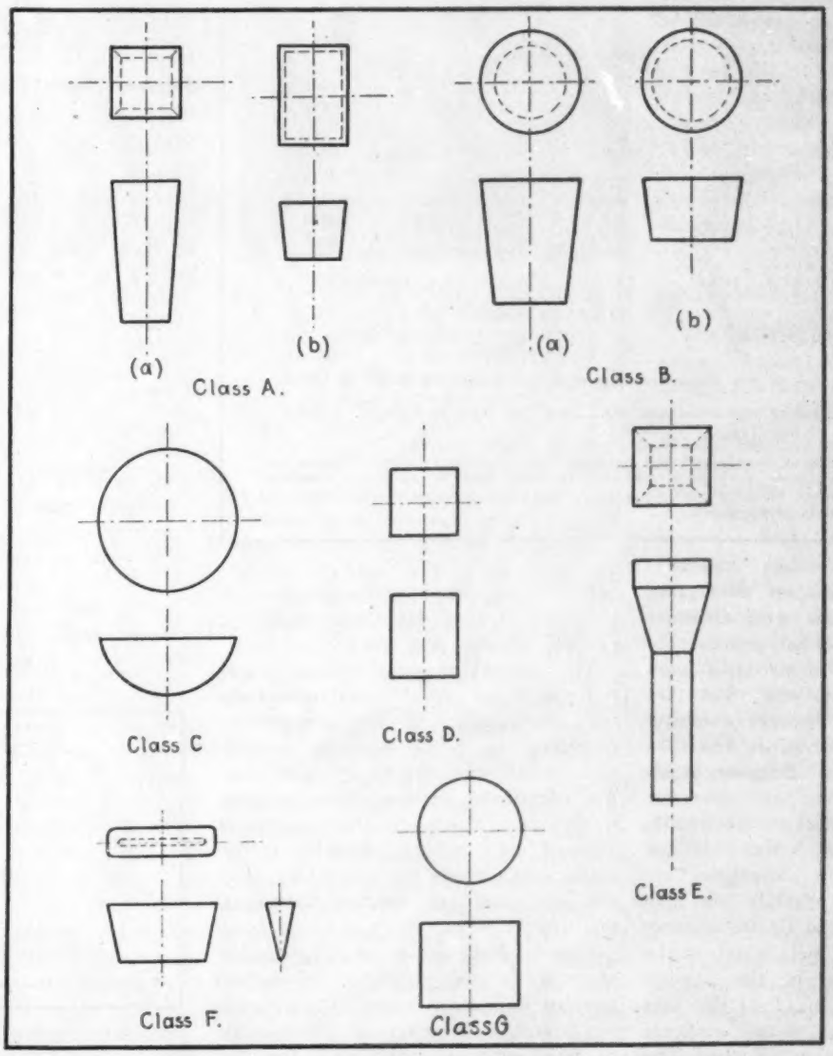


FIG. 1—CLASSES OF LADLE INGOTS

A part of the report submitted to the American Society for Testing Materials at the annual meeting, June 27-30, 1916. The authors are associated with the Bureau of Standards, Mr. Cain as associate chemist, and Mr. Rawdon as assistant physicist.

in different portions of the print. Figs. 2, 3 and 4 illustrate how sulphur follows carbon in its segregation. The outline sketch, Fig. 2, of the section of one of the ingots shows the number and distribution of the blowholes; the several areas which etched rather dark in acid being shaded. A microscopic examination shows that these spots are areas of high carbon content as illustrated in the photomicrograph of one of these areas, Fig. 4. In Fig. 3, the sulphur prints of these same sections show similar dark areas, thus indicating higher sulphur content, exactly coinciding with the high carbon areas.

The segregation of sulphur is probably a mechanical process while that of carbon, phosphorus, etc., is more strictly chemical. The process of freezing of steel is a selective one; those portions solidifying first are lowest in carbon and other constituents which are dissolved in the iron at high temperatures. Sulphur exists as manganese sulphide which, so far as known, is not soluble in the iron at ordinary temperatures. Many of the tiny globules become entangled between the growing crystals but also many are pushed ahead by the advancing crystals into the melt which is the last to solidify, that is, the portion highest in carbon. In 11 of the sets examined, the metal shows evidence of having cooled rather slowly. The outer layer, sometimes ½ inch thick, in which the crystals are long and grow perpendicularly to the surface, shows a sulphur content considerably less than the interior. The appearance bears out the suggestion made that the sulphides are pushed ahead by the growing crystals toward the still liquid center.

A microscopic survey of sections of selected ingots was made with the purpose of determining the amount of surface decarburization, the nature of the metal bounding the blowholes and gas cavities, and the location of areas of pronounced segregation of carbon. The specimens used were cross-sections of the ingots at one-third the height from the base except that in the case of low, flat forms a medial vertical section was used.

The amount of surface decarburization, such as can be determined by the microscope, of the metal surrounding the holes is slight and almost negligible except in one case. The depth of surface decarburizaton is also very much less than is usually allowed in drilling samples. The metal surrounding the blowholes, with the one exception, showed no abnormalities.

Unless the areas of segregation show a decided difference of carbon content compared with the surrounding metal, it is practically impossible to map with certainty such areas in cast steel which is so coarsely crystalline as are these samples. Fig. 4 shows that spots of very high carbon content are formed and that they are associated with a similar high sulphur content. The analytical results show considerable variation in carbon in some cases and it is believed that carbon differences of this order cannot at present be detected by the microscope under the conditions imposed by this investigation.

Table I

Results of Examination of Sections of Selected Ingots

Class of ingot.	Number of Blowholes. Oxidized.	Unoxidized.	Total.	Remarks.
A—*a*	13	1	14	.....
A—*a*	10	5	15	Mostly small skin blowholes.
C	6	5	11	Large central holes.
A	0	1	1	½-in. central hole.
B—*b*	0	2	2	Small
B—*b*	21	30	51	Most are near edge.
C	4	0	4	One very large one, near top.
C	5	0	5	Large, near top of ingot.
B—*b*	0	6	6	Small, central.
B—*b*	59	14	73	Mostly small skin blowholes.
A—*a*	0	19	19	Deep seated.
A—*a*	5	3	8	Deep seated.
E	5	2	7	Deep seated.
E	7	2	9	Deep seated.
F	13	1	14	Some large, scattered.
B—*b*	0	7	7	Small.
F	1	16	17	Small.

Number in which most of the holes are oxidized (at least two-thirds of total number) 8
Number in which most of the holes are unoxidized (at least two-thirds of total number) 6
Number in which oxidized and unoxidized are fairly equally divided..... 3
Under heading "oxidized blowholes" are included those cavities which showed any trace of color whatever, so that the showing is worse than it really was observed to be. The number of holes containing a thick coating of scale was considerably less than the totals given above.

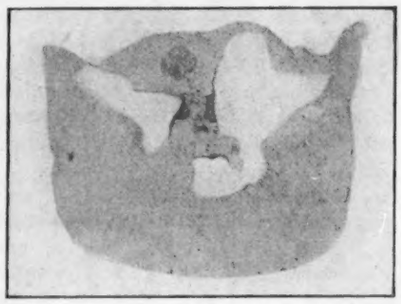


FIG. 2 — SECTION OF SPLIT INGOTS SHOWING GAS CAVITIES AND CARBON-SEGREGATED AREAS (SHADED), AS REVEALED BY DILUTE NITRIC ACID ETCHING

Selecting Ingot Types for Examination

In selecting ingot types for the chemical study of homogeneity it was decided to limit the examination to grades containing approximately 0.4 and 0.7 per cent of carbon, inasmuch as these were more fully represented among the various types submitted than were the very high and very low carbon grades. The survey was limited to the elements carbon, sulphur, and phosphorus, these being most liable to segregation and of greatest importance in determining the quality of steel.

In deciding upon a plan for a systematic scheme of drilling these small ingots at certain predetermined places, as is usual in ingot surveys, a number of difficulties at once presented themselves. For this reason the metallographic study did not give the assistance which was expected of it, and

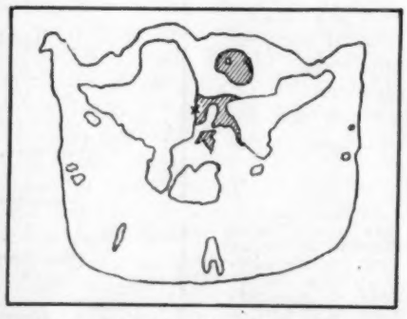


FIG. 3—SULPHUR PRINT OF SECTION SHOWN IN FIG. 2

consequently, the best that could be done in selecting places to drill the ingots for chemical study of segregation, was to drill at approximately four positions in the ingot. In some of the semi-spherical ingots no holes were put in through the scale of oxide on the surface, as this was so thick and irregular and so honeycombed with cavities that it would have been impossible to drill here. Instead, the holes were spaced on the under surface as nearly in accordance with the general scheme as possible. In drilling the small wedge-shaped ingots it was found necessary to put in two and sometimes three adjacent drill holes, because of the thin section after surface discard, in order to get a volume of metal equivalent to that usually represented by a drill hole. Thus, drillings from such ingots represent a larger area than in the case of other ingots and this should tend to average differences in composition found in the single drill holes.

It was thought that by using the same size drill and always carrying the drill hole to the same depth a means would be offered of measuring the ingot soundness at the place drilled. This was accomplished by carefully preserving all drillings after surface discard and weighing them. A flat V-shaped, ½-inch drill was used, and by placing a stop on the shank it was arranged that all drill holes should be 1 inch deep. Allowing for irregularities in this somewhat rough adjustment, the weight of drillings to be expected from such a drill hole with sound metal would be 22 to 24 grams. Marked shortage in this weight was then a direct measure of unsoundness. By this method it was found that of 46 places drilled 25, or over 54 per cent, were unsound.

Character of Drillings Obtained

The drillings obtained presented much variation in physical character, ranging from dust, through long thin chips to curled-up masses, and were frequently full of visible scale and large pieces representing walls of blow-holes broken off by the drill. The sharpness and angle of the drill, the pressure on same, and its speed were kept as nearly constant throughout as was possible, so that these differences in physical character of drillings were due solely to the nature of the metal at the places drilled. As will be seen later, some of these drillings presented difficulties from the analytical chemical standpoint.

For determination of carbon, the barium-carbonate-titration method was used; for sulphur, the evolution method with theoretical standard for iodine solution; and for phosphorus, the alkalimetric method with theoretical standard for the volumetric solutions. By employing the theoretical standard for the volumetric solutions used in the phosphorus and sulphur determinations, there was eliminated all question as to similarity between standard steel and the steels worked upon, in case a standard steel had been used for standardizing these solutions, and the results for all ingots are therefore strictly comparable.

Discussion of Analytical Results

Of the ingots examined, 15 or over 65 per cent, were non-homogeneous as to carbon, nine, or over 39 per cent as to sulphur, and nine, or over 39 per cent as to phosphorus. The sulphur and carbon appear to behave somewhat similarly in that a sulphur difference is usually accompanied by a carbon difference, but not always

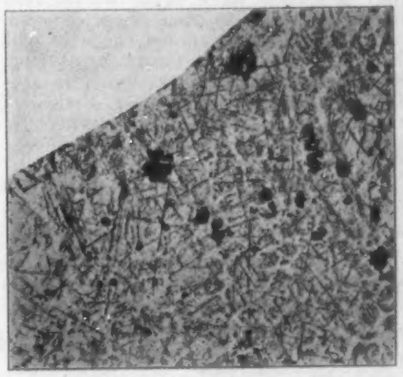


FIG. 4—PHOTOMICROGRAPH OF SPOT X IN FIG. 2. THE DARK NEEDLES ARE FREE CEMENTITE, INDICATING A CARBON CONTENT CONSIDERABLY ABOVE THE EUTECTOID RATIO

vice versa. The phosphorus differences are not so great as the others and do not connect themselves up closely with the sulphur and carbon results. There is a general parallelism between the indications of the sulphur prints and the analytical results and in interpreting this it should be borne in mind that the sulphur prints were not taken on the ingots drilled but upon a companion set.

It is believed that there is a tendency for deoxidation in the regions surrounding blow-holes, whose walls are covered with oxide scale, and the effect of this would be to reduce the carbon content of the metal in such areas. There may also be an effect in apparently reducing the sulphur content, since the ferric chloride formed from the scale contained in the drillings, when dissolving these for the evolution sulphur determination, would tend to oxidize the evolved hydrogen sulphide, thus giving low results by this method.

Further practical disadvantages of such ingots have already been indicated, namely, the inconveniences in drilling them and the possible analytical errors resulting from the character of drillings obtained. The latter are due to the difficulty of burning large pieces chipped from walls of blow-holes when determining carbon by direct combustion of the drillings, the possible effect of oxide scale on the evolution-sulphur determination and, the effect of scale on the phosphorus determination. The scale is relatively insoluble and present in large flakes, hence probably it would introduce an error into rapid silicon determinations unless correction were made by volatilizing, thereby prolonging the time needed for this determination.

Causes of Segregation

Evidence of some segregation in sulphur and carbon is shown by some of all of the different shapes used. No one shape or size can be said to be the worst in this respect. The apparent variations in the rate of freezing of the different forms make it difficult to attribute any segregation observed to any one cause.

The future contemplated work on this subject will aim to secure sound ingots of the shapes and sizes already examined.

New Chemical Course

The Massachusetts Institute of Technology, Boston, announces the establishment of a new school of chemical engineering, which is expected eventually to develop means of making this country independent of foreign nations in the production of chemical supplies. The school will include regular courses with a resident professor at five or six industrial plants, each equipped with a fireproof research laboratory. These stations are to be located in Somerville, Mass., Bangor, Me., Niagara Falls, N. Y., Allentown, Pa., and New York or Chicago. The course, which leads to a master's degree after five years of study, includes 3½ years at the institute, nine months at the several industrial plants and the last nine months in the institute laboratories. The school will be opened in time for registration in September.

The Russell-De Wolfe Co., Chicago, describes its plugs for repairing leaks in pipes, fittings, gas receivers, condenser or evaporator tubes, hot water heaters and tanks, in a recent circular.

Plea for International Standards

IN THIS able article the history of the movement toward the adoption of uniform international standard specifications is reviewed, with particular reference to the work of the International Association for Testing Materials. The advantages of uniform specifications in fostering export trade are pointed out

BY WILLIAM R. WEBSTER

WHILE the International Asciation for Testing Materials undertook in 1895, at its organization in Zurich, the standardization of methods of testing, and the introduction of international specifications, nothing was actually accomplished in the matter of international specifications until the atmosphere had been very much cleared up by the work of the standards committees in various countries. The conflicting requirements on export orders, the trouble they gave, and the success of the American Society for Testing Materials in overcoming similar difficulties on home orders by the introduction of standard national specifications led the International Association to undertake the standardization and introduction of international specifications for steel. It was finally decided to consider for each class and from each country, materials of only one standard specification prepared by an equal number of representatives of both the manufacturing and consuming interests.

The following specifications were agreed to as representative national specifications: English specifications published by the Engineering Standards Committee, London; German specifications recognized by the Deutscher Verband fur die Materialprufungen der Technik; and American specifications adopted by the American Society for Testing Materials.

The manufacturers of each country were asked to become familiar with the standard specifications of each of the other two countries, and to work to them whenever they were called upon to do so. It was expected that in this way the manufacturers would gradually become accustomed to the points of difference in the three standard specifications, and that these differences might then be harmonized and a single specification agreed upon for each class of steel, the International Association for Testing Materials thus becoming a clearing house for international specifications.

This plan was, however, rejected on the claim that it gave the same value to the steel from each country although manufactured under different specifications. It was fully explained by the American members of the committee that:

"The time has passed when any specification or set of specifications with clauses calling for low phosphorus requirements based on favorable ore conditions, would tend to confine orders to any one locality or country inasmuch as the basic and duplex processes have equalized matters in this respect so that there is now no commercial advantage to be gained by insisting on specifications of this kind. Such matters can now be settled by the committee on their intrinsic merits, without reference to their commercial bearing."

After considerable delay and discussion it was proposed to start with a single specification that could be agreed upon for each class of material, and for this purpose the adoption of Lloyd's specifications for ship material with the addition of chemical requirements for sulphur and phosphorus was suggested for adoption as an international specification.

Objections were raised to these chemical requirements, and although it was shown that they were in accordance with the standard practice in this country, this had no effect whatever, and these requirements had to be withdrawn. It was then claimed that Lloyd's specifications were already recognized as international specifications, and that their adoption by the Association would not give them any added weight. Although it was frankly admitted that these specifications were satisfactory in every respect, there was an unwillingness towards their adoption as international specifications. Lloyd's specifications for ship material were thus rejected, and this practically put an end to the whole matter of international specifications after several years of useless work on the part of sub-committees in each of the three countries, who did not at first appreciate that they were really working at cross purposes.

The International Railway Congress Association at its congress in Berne in 1910 discussed the advantages of international specifications for iron and steel, and passed resolutions showing its great interest in the work at that time and its desire for information as to progress by the International Association for Testing Materials.

Unfortunately there has ben little or nothing to report since then, as the action of the International Association for Testing Materials at its New York Congress in 1912 practically put an end to international specifications before anything had been accomplished. A number of our own standard specifications were translated into foreign languages for the use of the members of that congress. The secretary of the International Association for Testing Materials, when asked to send copies of these specifications to the members of the International Railway Congress Association in view of its request for such information as shown by the above-mentioned resolutions, or to authorize the American Society for Testing Materials to distribute them, replied that if the English and Germans should translate their specifications into other languages and make the same request, the council would authorize such distribution.

Fortunately some of our steel manufacturers and locomotive builders, etc., distributed these specifications through their representatives abroad, and found that when the foreign engineers had these specifications before them in their own languages it was of great assistance in securing orders based on our specifications. This was the unanimous report of those who followed this course and showed clearly that the best course to follow is to improve the American standard specifications wherever possible and to bring these specifications to the notice of engineers in foreign countries, and thus to make them available for use on export orders.

The American Society for Testing Materials is to be congratulated that Secretary Redfield of the department of commerce has become interested in this matter and has seen the great advantages that would accrue to the manufacturers of this country by following such a course. He has therefore agreed to translate and publish

Portions of a paper presented at the 1916 annual meeting of the American Society for Testing Materials, Atlantic City, N. J. The author, W. R. Webster, is a civil engineer, 411 Walnut street, Philadelphia.

many of our specifications into Spanish, French and Portuguese. Each specification will have the original English version attached to it, and all numeric quantities will be given in both the British and the metric system. The department of commerce will also distribute these specifications among engineers abroad through its own staff and the United States consular offices.

Further Recommendations

Since our specifications differ in some respects from those in general use abroad, a special committee of the American Society for Testing Materials should be appointed to which all matters connected with differences with foreign specifications might be referred for explanation or investigation. In this way prompt action would be secured, and any matters of sufficient importance might be referred to the standing committee which has that particular class of material in charge.

It is not reasonable to expect that foreign engineers who have had satisfactory results in service from materials manufactured in this country under their own specifications will consider placing orders here under our specifications unless they can thus secure more prompt delivery. Nevertheless, the specifications should be sent them so as to be available when needed.

There is also decided objection in England to steel made by the duplex process, although we are getting excellent results in this country from steel made by this process. On investigation we find that in England the basic-bessemer process is used at the start, and is followed by the open-hearth process. No doubt some of the highly oxidized basic bessemer metal is carried through the open-hearth furnace to the finished product and this would account for the objections to this steel.

In this country the metal is first blown in the acid bessemer converter, and is not as highly oxidized as that from the basic bessemer converter, which doubtless accounts for the better results obtained from the steel manufactured by the former method. In ordinary American practice the duplex-process steel is now supplied on orders calling for basic open-hearth steel, without making any distinction whatever, whereas on export orders it has always been necessary to explain carefully the differences between the processes of manufacture in this country and abroad, when it is desired to use duplex steel on orders calling for basic open-hearth steel. Additional variations are found between foreign specifications and ours in the matter of drop tests on rails. These have given considerable trouble owing to the great variation in the conditions under which such tests are made here and abroad. For instance, the weight of the tup varies from 2,000 to 2,400 pounds; the distance between supports from 3 feet to 3 feet 6 inches and 4 feet; and the length of the test rail may be 6 feet or 30 feet. The matter is complicated much further by the different weights of the anvils used, and the character of their foundations, by which the effectiveness of the blow of the falling weight is so largely affected. In this country the standard drop testing machine is in general use at all rail mills. This has also been adopted by the American Society for Testing Materials, and its use is called for in the standard specifications of the society.

Some foreign specifications prescribe a drop test of 30 feet for rails 30 feet long. For rails of the same weight other specifications require an 18-foot drop test for rails 6 feet long.

In order to find out just what this difference in the requirements meant, a series of comparative tests were made, and it was shown that the long overhanging ends of the 30-foot rails act as cantilevers, supporting the central part, and that the 18-foot drop test is more severe on a piece of rail 6 feet long, than the 30-foot drop test on a 30-foot piece of rail.

Another complication in the use of foreign specifications on export orders is that often minor points of difference cannot be settled quickly. The responsible engineers are usually far away, and there is not time to refer questions to them for decision. In cases where the specified chemical requirements do not agree with the physical requirements, the inspector is sometimes forced to reject material that he knows from his experience to be satisfactory. It may even give better physical results than those specified, but may fail to meet all the specified chemical requirements. Much of the existing confusion is no doubt due to the general change from acid open-hearth to basic open-hearth steel, since a higher carbon content is required in the latter for the same ultimate strength. This is better understood now than formerly when some of these specifications were first drawn up.

These differences are only a few of those which have been encountered in working to foreign specifications, but they suffice to show the advantages that would be derived from the use of standard national specifications, such as those of the American Society for Testing Materials.

A careful study of foreign specifications will bring to our attention requirements and proof tests that are not in general use here. These should be thoroughly investigated, and in so far as they may be found to afford valuable additional checks on the quality of the material, they would doubtless be adopted in our own specifications. In this way we may hope gradually to secure standard national specifications that will embody the best features of the foreign specifications, and become the nearest approach to international specificatons that we can expect to obtain.

English Prejudice

It is natural that any country having iron ores low in phosphorus and sulphur will make very strong claims in favor of the use of acid open-hearth steel in preference to basic open-hearth steel. But in a country like our own where both acid and basic open-hearth steels are made in large quantities and are used side by side for most purposes, it is rather hard to understand the decided prejudice in England against basic open-hearth steel. On looking into this matter we find that it is partially due to their former experiences with this steel when the operations in the manufacture of basic steel were not so well understood as at present, and to the prejudice that has always existed in that country against basic bessemer steel. It has been shown, too, that basic open-hearth steel made from very high phosphorus iron is not as reliable as that made from the lower phosphorus iron used in this country.

Finding Rail Flaws

An examination of the possibility of detecting flaws in steel rails by a magnetic method has been undertaken by the federal bureau of standards, Washington, D. C. Two 15-foot sections of an 80-pound rail were used. Artificial flaws introduced into these specimens can be located by magnetic measurements made with large coils which are arranged to slide along the rails. This investigation is carried on in co-operation with the engineering division of the bureau, the mechanical tests and magnetic tests being complementary. The results so far obtained indicate that the magnetic method of finding flaws in rails may possibly become commercially feasible, although much remains to be done in that direction.

Oil and Water Quenching of Axles

THE CHARACTERISTIC physical properties of a carbon-steel forging resulting from the two different methods of treatment—oil and water quenching—have been the subject of no little discussion. Tests indicate but slight differences in the product, although water quenching seems to be more preferable

BY C. D. YOUNG

THE investigation discussed in this article was made in order to show the difference between the physical properties of a large forging quenched in water and those of a similar forging quenched in oil.

The results obtained indicate that there is an advantage in the use of water as a quenching medium, as might be expected from its physical properties. Results obtained at a large heat-treating plant, which has turned out thousands of tons of quenched-and-tempered carbon steel, indicated that no disastrous effects on the forgings are to be anticipated from the use of water as a quenching medium, providing proper care is taken in the handling of the steel throughout the process. The forgings used for this experiment consisted of two 10-inch locomotive driving axles having a center bore 2 inches in diameter extending the entire length. Both axles were from the same melt of steel, and preliminary chemical analysis indicated the same chemical composition. One axle was treated at the Juniata shops of the Pennsylvania Railroad Co. by water quenching, and the other axle by a steel company which makes a practice of oil quenching.

The axle marked *W* was heated to 1,550 degrees Fahr., and at that temperature quenched in water at about 60 degrees Fahr. Then, in a furnace maintained at 1,175 degrees Fahr. it was heated to that temperature and cooled therefrom in the air on a dry ground floor. That is, this axle, after being quenched from 1,550 degrees Fahr. in water at about 60 degrees Fahr., was "drawn" to a temperature of 1,175 degrees Fahr. Similarly, the axle marked *O* was quenched in a heavy oil from the same temperature (1,550 degrees Fahr.) and drawn in a furnace to 1,200 degrees Fahr, the cooling being done in the air the same as for the water-quenched axle.

It was aimed to have the tension tests on both axles show an elongation in 2 inches of about 22 per cent. After treatment, the axles were laid off for cutting up into tension test specimens, as shown in Fig. 1. It will be noted, in effect, that out of each axle there were cut—axially and for the full length, 120 degrees apart—three radial and straight slabs of the overall thickness of a test specimen, and out of each slab five 6-inch lengths, each identified as to its original location in the axle, whether cut from the end and from which end, or whether from the center, or from midway between center and end, and from which slab; and then each 6-inch length was cut lengthwise into three specimens and their location further identified as to whether cut from the inner or outer circumference or from the middle of the wall.

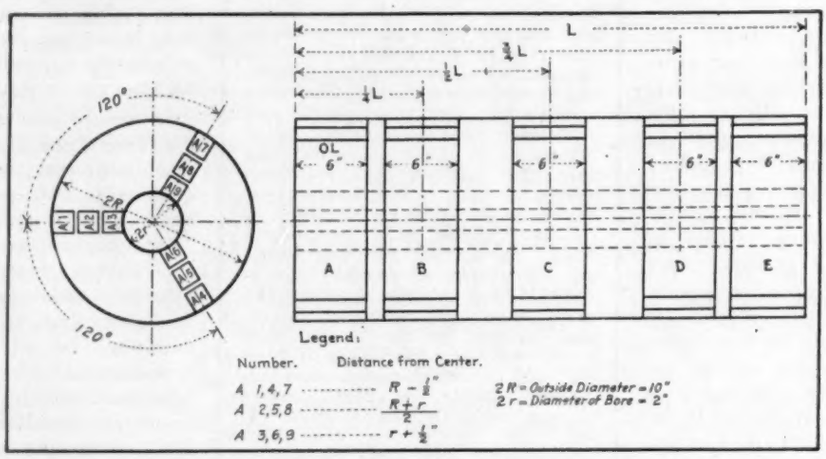


FIG. 1—LOCATION OF TEST SPECIMEN CUT FROM AXLES

As shown in Fig. 1, the identification marks for the five 6-inch lengths, in order from one end, are, respectively, *A*, *B*, *C*, *D* and *E*. It is also shown that the specimens from length *A*, for example are numbered radially from the outside of the axle toward the axis, the three specimens from the first slab being numbered, as described, 1, 2, 3 throughout; second slab 4, 5, 6; third slab 7, 8, 9, respectively. The specimens from lengths *B*, *C*, *D* and *E* also have the same numbering as those of length *A*.

As already explained, the letter *W* applies only to the water-quenched axle and *O* on to the oil-quenched. For example, the markings *WC*2, *WC*5 and *WC*8 each apply to a different slab, but all refer to specimens cut from the water-quenched axle, from its central 6-inch length, and from the middle of the wall. The corresponding specimens for the oil-quenched axle are *OC*2, *OC*5 and *OC*8. Altogether there were 45 specimens per axle, 15 specimens from the three longitudinal planes through the axle and nine specimens from all three slabs from each of the five 6-inch lengths. The test specimens were turned up to the standard 2-inch gage length, ½-inch in diameter. The elastic limit was determined by means of a strain gage. All tests were conducted on on the same 100,000-pound tension testing machine using a machine speed of ⅛-inch per minute for both the elastic limit and the tensile strength.

Results of the tension tests are summarized in Table I, in which it is shown that the average results are more nearly uniform with respect to the length of the axle than with respect to distance from the axis. This is probably due to segregation, as it was found by chemical analysis that the carbon content was not uniform throughout the section. Segregation is perhaps to be expected in the ordinary output of commercial forgings, but not to the extent found here. Table II for chemical segregation.

A comparison of the average physical properties of all test specimens from both axles, Table I, shows that with an elongation 4.5 per cent less than that of the oil-quenched axle, resulting from the difference in treatment, the water-quenched axle gave

Read at nineteenth annual meeting of the American Society for Testing Materials, Atlantic City, N. J., June 27 to 30, 1916.

an elastic limit 6.6 per cent greater, about the same tensile strength and nearly the same reduction of area.

Table I gives the average results from all test specimens located equidistant from the axis in each axle. The average results from the outer test specimens at the location $R - \frac{1}{2}$ inch, shows the water-quenched axle to have about the same elongation as the oil-quenched axle, seven per cent greater elastic limit, five per cent greater tensile strength and six per cent greater reduction of area. as already stated, the average strength of the entire section came out very closely the same for both.

The results obtained from test specimens from the inner surface of the wall are not so consistent; that is, they show a higher elastic limit and a lower tensile strength, elongation and reduction of area for the water-quenched axle.

All of the forgings tested meet the requirements of the specifications of the American Society for Testing Materials, except that the elastic limit,

Table I.

Summary of Results of Tests

Location from End	Location from Axis	Specimen Marks. Water Quenched.	Specimen Marks. Oil Quenched.	Elastic Limit, lb. per sq. in. Water Quenched.	Elastic Limit, lb. per sq. in. Oil Quenched.	Tensile Strength, lb. per sq. in. Water Quenched.	Tensile Strength, lb. per sq. in. Oil Quenched.	Elongation in 2 in., per cent. Water Quenched.	Elongation in 2 in., per cent. Oil Quenched.	Reduction of Area, per cent. Water Quenched.	Reduction of Area, per cent. Oil Quenched.
OL	....	*WA*	*OA*	54,857	51,250	97,111	97,650	22.1	23.2	39.9	41.9
L/4	....	*WB*	*OB*	52,634	52,160	96,637	97,304	22.8	25.2	40.3	45.7
L/2	....	*WC*	*OC*	55,626	51,230	96,472	96,880	23.7	25.1	44.0	46.8
3L/4	....	*WD*	*OD*	56,064	51,170	96,470	96,030	23.1	23.5	42.5	40.7
L	....	*WE*	*OE*	53,376	49,780	95,720	94,210	23.6	24.0	44.3	41.7
Aver.	.....			54,509	51,118	96,482	96,415	23.1	24.2	42.2	43.4
		Location from Center									
....	R—½ in.	*W* 1,4,7	*O* 1,4,7	55,216	51,423	94,187	93,719	25.6	26.0	52.7	49.7
....	$\frac{R+r}{2}$	*W* 2,5,8	*O* 2,5,8	51,064	48,390	95,508	92,572	24.4	25.5	44.5	45.8
....	r+½ in.	*W* 3,6,9	*O* 3,6,9	57,255	53,543	99,751	102,962	19.2	21.2	29.7	34.5
....	$\frac{R+r}{2}$	Minimum permitted by A. S. T. M. Specifications		50,000		80,000		20.0		40.0	

Table II.

Chemical Composition of Specimens

Specimen Marks. Water Quenched.	Specimen Marks. Oil Quenched.	Carbon, per cent.	Manganese, per cent.	Phosphorus, per cent.	Sulphur, per cent.	Silicon, per cent.
WA 4	.....	0.53	0.56	0.019	0.031	0.159
WA 5	.....	0.53	0.56	0.018	0.030	.....
WA 6	.....	0.61	0.58	0.019	0.039	0.158
WE 4	.....	0.53	0.56	0.019	0.030	0.162
WE 5	.....	0.53	0.56	0.019	0.032	.....
WE 6	.....	0.61	0.57	0.025	0.040	0.299
WD 3	.....	0.62	0.57	0.023	0.042	0.176
.....	*OA* 4	0.55	0.56	0.018	0.030	.....
.....	*OA* 5	0.55	0.57	0.018	0.033	0.190
.....	*OA* 6	0.63	0.59	0.019	0.041	0.195
.....	*OE* 4	0.52	0.55	0.021	0.036	0.167
.....	*OE* 5	0.54	0.56	0.019	0.031	0.182
.....	*OE* 6	0.60	0.59	0.019	0.038	.....
.....	*OD* 9	0.62	0.57	0.020	0.044	0.176

The test specimens from the middle of the wall show lower elastic limit and tensile strength than either the outer or inner test specimens, except that the strength of the water-quenched axle at the middle of the wall was found to be somewhat higher than in the outer specimens. It is evident that this mid-region of the section was less affected by the heat treatment. The water-quenched axle, however, shows higher elastic limit and tensile strength in this region than the oil-quenched axle, although, found in the middle of the wall in the oil-quenched axle is somewhat low.

Figs. 2 and 3 show photomicrographs taken from test specimens *WE6* and *WD3* on the water-quenched axle. It will be noted that the physical properties of these two specimens were quite different, specimen *WD3* showing higher elastic limit and strength but lower elongation and reduction of area. The microstructure does not afford any apparent explanation for this difference in physical properties, but in both cases indicates

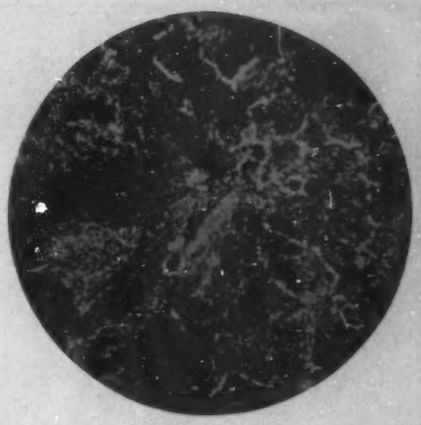


FIG. 2—SPECIMEN WE6, MAGNIFIED 100 TIMES

Average moderately coarse-grained, very irregular structure; sorbite with a trace of ferrite network; some spots have much ferrite and a trace of slag, while in other places there are areas in which the ferrite is completely diffused into the sorbite.

that the water quenching was effective in securing a good diffusion of the carbon throughout the structure, leaving only a small amount of ferrite network. The carbon content in these two specimens was about the same, slightly over 0.60 per cent.

Figs. 4 and 5 show photomicrographs taken from test specimens *OE4* and *OD9* of the oil-quenched axle, the latter having shown higher elastic limit and tensile strength, with lower elongation. Again, no explanation of this is apparent from the microstructure, except that specimen *OE4* indicates a lower carbon content, which was confirmed by chemical analysis. The carbon content in specimens *OE4* and *OD9* was 0.52 and 0.62 per cent, respectively.

The structure of the oil-quenched axle shows a fine network, which is

FIG. 3—SPECIMEN WD3, MAGNIFIED 100 TIMES

Average moderately coarse-grained, slightly irregular structure; sorbite with a trace of ferrite network; there are many areas where the ferrite is completely broken up by the heat treatment; a few tiny slag inclusions are scattered through the steel; more regular and less ferrite than WE6.

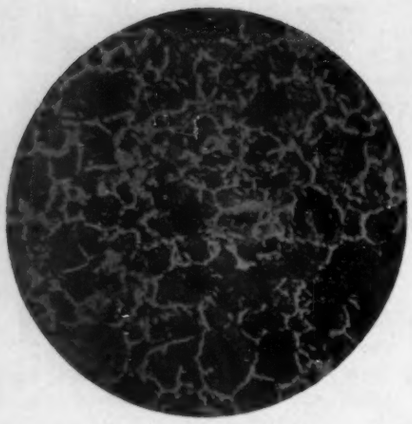


FIG. 4—SPECIMEN OE4, MAGNIFIED 100 TIMES

Average fine-grained, slightly irregular structure; sorbite with a slightly thick ferrite network and clusters of ferrite with a small amount of slag; structure more regular but with more ferrite than OD9.

absent from the water-quenched structure, although characteristic of carbon steel treated by the oil-quenching method. Table II gives the chemical analysis of representative test specimens taken from each axle. The water-quenched axle samples, taken from the *A* end, Fig. 1, show that the outside and midway specimens *WA*4 and *WA*5 have the same carbon content, but when compared with analysis from specimen *WA*6 of the inner wall, there appears a segregation of 15 per cent. The same is true of the samples taken from the opposite end of this axle.

Carbon Content

In the oil-quenched axle also, the same segregated condition is present, the outer and middle test specimens having about the same carbon content, while the specimens *OA*6 and *OE*6 taken close to the inner surface, show a segregation of 14.5 and 11 per cent, respectively, when compared with the corresponding samples taken from the middle of the wall.

The segregation found in both of these axles indicates a condition which increases the difficulty of securing a satisfactory treatment of the forgings, and points to the desirability of including in all specifications for forgings which are to be heat treated, a clause to govern the allowable amount of segregation; otherwise it may be expected that extreme segregation will be found, as in the forgings here discussed.

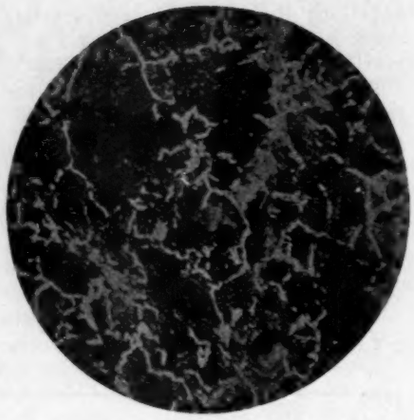


FIG. 5—SPECIMEN OD9, MAGNIFIED 100 TIMES

Average moderately fine-grained, irregular structure; sorbite with an irregular ferrite network, a few clusters of ferrite and a trace of slag.

Methods of Testing for Pipe Corrosion

A SERVICE test, or at least a test under service conditions, is the only reliable method for determining the relative durability of iron and steel products. However, to be of any value it must be possible to carry such a test to conclusion in a reasonable time. The so-called acid test quickly attracted attention, but as this proved to be misleading the effect has been to discount any attempt to accelerate corrosion. Nevertheless, there are certain conditions commonly found in service where the pipe is subject to aerated water at a temperature of 140 to 180 degrees Fahr. under pressure, where corrosion is very severe.

The main factors controlling corrosion in water and steam pipes are: The amount of free oxygen in solution in the water; the volume of flow, which is an important factor, mainly on account of the greater amount of oxygen available; and the temperature. Corrosion increases with the temperature, reaching a maximum somewhere between 160 and 180 degrees Fahr.

These conditions are reproduced in the apparatus shown in Fig. 1. This consists of a tank or reservoir open at the top, which may be filled with a supply of any kind of water selected for the test. This water is maintained at any desired temperature by means of a small gas heater *B* fitted with a thermostat, or a steam coil may be inserted if more convenient. An ejector is provided at *C* and operated by air under three or four pounds pressure. The air should first be passed through a mass of excelsior or similar material to remove oil. The heated water is thus aerated, forced up through the coil of pipe and discharged continuously into the top of the tank. The coil consists of alternate lengths of the materials under test. A glass tube may be inserted in the coil if it is desired to observe the flow. By keeping up a continuous flow in this way at a temperature of 160 to 180 degrees Fahr. the relative tendency of pipe to corrode may be determined in three to four months. The amount of corrosion found in that time with this apparatus will be found equal to about two years under the same conditions in actual service.

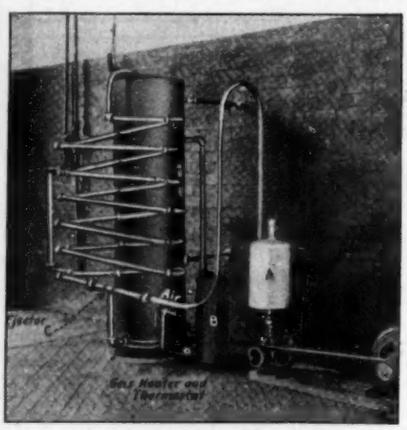


FIG. 1.—APPARATUS FOR CORROSION TESTING, USING AERATED HOT

The acceleration of corrosion in this apparatus is principally due to the continuous flow and the greater amount of oxygen and carbonic acid which is thereby brought into contact with the interior surface of the pipe. The details of this machine may be altered according to local conditions. If the water is not fresh and almost pure, the supply should be renewed from time to time.

The amount of corrosion in both wrought-iron and steel hot-water-supply pipe, as measured by the depth of pitting, will frequently amount to about 0.1 inch in two years. We have found with this apparatus nearly this amount of corrosion in a pipe of this kind in three months, with the water circulating at the rate of one to two gallons per minute. The relative depth of pitting is apparently the same in each case.

This paper was read at the nineteenth meeting of the American Society for Testing Materials, Atlantic City, N. J., June 27 to 30, 1916.

The St. Louis Refractories Co., St. Louis, Mo., is remodeling its entire plant. Facilities are being added for the manufacture of silica brick and silica shapes of all kinds in addition to magnesite refractories.

WHAT'S WHAT and WHY

Don't Ask Yourself-Ask Us!

Questions from our Readers answered by Experts

Additional Pig Iron Capacity

What added pig iron capacity is being built up in the west to meet larger demand for iron and steel?

At least five blast furnace stacks are under way, four at the Gary works of the Illinois Steel Co., Gary, Ind., and one at the Inland Steel Co.'s Indiana Harbor plant. The new plant of the National Tube Co. at Gary, Ind., will have at least two stacks. In addition to this added capacity, which is certain to be built, several merchant stacks are under consideration in the St. Louis district. Stacks in connection with steel works are more likely to be built under present conditions than are merchant stacks, since the demand for steel is very heavy while existing plants are sufficient to care for the demand for foundry and malleable irons.

Preparing Paint for Structural Steel

Kindly let us know what equipment is necessary in order to prepare paints for structural steel work. We wish to make our own mixtures in large quantities.

The chief item of equipment in a paint factory is the grinder. Its principal working element consists of a pair of burrstones similar to those used in country grist mills. These stones are of a cellular, but very compact silicious rock. They are about 30 inches in diameter and 5 inches thick, and are mounted in a horizontal position so that with one stationary and the other revolving rapidly, the pigments will be thoroughly mixed and ground to any desired consistency. The faces are "sharpened" by cutting shallow grooves that radiate from points in a circle concentric with the burr center. As the sharpening has to be done every day or so, the work may be greatly facilitated by using air chipping hammers. A small, electrically-driven air compressor will take care of the hammers. A hoist and trolley system is convenient for transferring the burrs to and from the sharpening room. The building should be fireproof or isolated. It should be two stories, with the weighing and compounding room overhead. The materials can then be supplied to the grinders by gravity. A basement under the grinders permits the installation of an easy system for packing and shipping the paints.

Foundations for Steam Hammers

Which is the better foundation, wood or concrete, for a steam hammer forging steel?

There is no positive answer to your question, as practice differs. The rigid concrete foundation gives greater effectiveness to the blow, as the work must absorb practically all the energy of the hammer head. There is no give or spring to dissipate the energy. On the other hand, the hammer should be designed with an extra rigid frame and have a heavy anvil in order to operate on a concrete foundation. In other words, the foundation should be made to suit the hammer as well as the work.

It is claimed that slower action is required when forging steel, so that the force of the blow can penetrate to the center of the work. It is believed by some that the yielding wooden foundation delays the force of the blow somewhat, so that the energy gets into the metal instead of being used up by battering the surface of the piece. Generally speaking, the larger the piece, the slower must be the application of the force, and this can be done either by having an elastic foundation or by using a press.

Chemical Analyses of Alloys

Will you please give the chemical analyses under which standard English ferro-manganese and domestic spiegeleisen are sold?

An average analysis of standard English ferro-manganese shows 80 per cent manganese, 6 to 7.50 per cent carbon, 1 per cent silicon, under 0.30 per cent phosphorus, trace of sulphur and the remainder, or 10 to 12 per cent, iron. Until recently, the practice has been to sell standard ferro-manganese on a guarantee of 78 to 82 per cent of manganese. Extraordinary market conditions in recent months have changed this somewhat and from 78 to 80 per cent now is commonly quoted. Standard domestic spiegeleisen analyzes 19 to 21 per cent manganese, 1 to 2 per cent silicon, 3.50 to 4.50 per cent carbon, 0.015 to 0.02 per cent sulphur, 0.10 per cent maximum phosphorus and the balance iron.

Electric Furnaces

Please state the number and capacity of electric furnaces of all types for making high grade steel now in operation or under contract in the United States; also, what were the comparative figures at the start of the present war?

The number of electric furnaces in the United States at the present time, as given by the statistics of those who are carefully following this development, is approximately 100, but the number is changing constantly, owing to rapid adoption of this process by makers of special manufacturing steels, tool steels, castings, etc. The capacity of these units is estimated at about 1,000,000 tons annually of crude and about 800,000 tons annually of finished product. At the beginning of the war, the number of furnaces was approximately 25, with an output of about 100,000 tons, crude; and 60,000 tons, finished.

Inculcating the Habit of Caution

THOUGH the market is full of all kinds of safety devices, experience has taught the employer that these are well nigh ineffective without the interest and co-operation of the workers themselves. Mr. Mix tells how the employes of a large factory were stimulated to do their share in promoting the interests of safety

BY MELVILLE W. MIX

THE successful salesman is the man who first "sells himself" on his proposition, who becomes so saturated with its merits, so enthusiastic in his beliefs, that his conviction is automatically transmitted to the buyer. Substantially the same principle holds with the modern safety movement; no manufacturer will make real progress in the movement until he takes a personal interest in it, and is able to transfer his enthusiasm and earnestness to those directly in charge of the work, and, through them, in turn, to the workers themselves. A form of evangelism is required, that arouses the spirit of all concerned.

In these days of workmen's compensation and high damage awards in employers' liability suits, the manufacturer will not be slow to grasp the main idea that "saving is earning", and to act accordingly. He will find the market full of "guards" of all kinds for all sorts of protecting purposes and places with a large supply of propaganda calculated to encourage him to spend endless sums on preventive appliances. He will find an army of inspectors ready and active, with unlimited recommendations and orders for every machine and for every nook and corner of his factory. He may be persuaded to buy all their equipment and to "protect" without limit, but if he is not himself converted to its efficiency and value, and if he has not the co-operation in spirit of his employes, foremen and superintendents, his investment counts for little.

In no place is there a more practical opportunity to develop the "save my pal" movement than in a factory or mill. Not only must the worker look out for himself, but his every thought, when engaged in hazardous work involving operations with which others have to do, must be, "how about my fellow worker"? When in a factory organization such thoughts become automatic from president to "sweep", then money spent for guards becomes a real capital investment; but without that spirit, its principal effectiveness is to expand the inventory and keep up the insurance rates.

We spend thousands of dollars in fire protection in order to reduce the hazard and save in operating expenses. We drill our factory fire brigades without thought of the cost, because we are educated by actual experience to realize what such losses mean in actual money and stoppage to business. It has taken years to learn the lesson, but we have done so, and fire protection is a recognized essential part of wise business administration. We do not stop at the installation of fire prevention appliances, but we put them under constant, careful inspection; we instruct every man in their location and uses; we leave no stone unturned to insure the effectiveness of the apparatus when called upon. But, with safety "guards", until we can see the same benefits in providing the same relative protection to the individual, until we can bring him to see how it affects him physically and financially to "keep right with the guards", we fail to realize the full benefit of the investment of money and time spent in education.

"The Human Scrap Heap"

In these days of scientific management and administration, there may be a tendency to the thought that, as such things do not seem to show immediate cash credits on the balance sheet, their importance may be set back for the moment for motion studies, rewards on operations, etc., but there is no economy in tolerating a condition that may require new men to be broken in to replace those impairments which might have been avoided by a little time spent in educating men and in arousing them to the safety first pitch. It is impossible to place a definite money value on a pair of eyes, a leg or an arm. While the expression "the human scrap heap" displeases us, we must know that there is such a thing, and that the right word at the right time may be effective in saving a fellow worker from that untimely and unseemly misfortune. Why not be practical and do all we can whenever we can to prolong the usefulness from the physical standpoint, if from no other, of every man or woman that we employ? Experience has developed that guards are not especially effective if, with them, we do not have the co-operation of the workman. If we make things automatically safe, we are quite as apt to do the worker an injustice in weakening his own spirit of self-preservation. Workers must recognize and respect danger and must be ever watchful in every phase of life, as well as when at work. The family must have it drilled into them; schools must preach and teach it; the citizen must be a party to the campaign of education, as only in that way may we be assured that "thinking first" comes before safety first.

Out of 30,000,000 male workers in the United States, about 7,250,000 are engaged in the general manufacturing lines. The annual loss due to fatal accidents is about one in 4,000, the lowest of the 18 principal occupational groups; yet from the sensational standpoint, the manufacturer is held up as the cause of nearly all physical suffering and loss due to occupational disaster. This situation would not exist if the manufacturer were more personally interested and inclined to fight for his rights and a proper recognition of his standing on the score board of national employment. Out of 22,500 fatal accidents in 1913, only 1,819 are attributed to the manufacturing occupations. Yet it can be much smaller if we will only approach the subject from the personal standpoint, evangelize with our employes, and arouse in them a spirit of co-operation and thoughtful, prudent regard for themselves and their fellow workers that will be automatic, and a habit for protection and carefulness, of which they cannot break themselves even if they should wish to.

To the extent that a management believes in these plans and encourages their use, just to that extent will it be rewarded with the association of an unimpaired, efficient organization of contented, prosperous and happy workers.

A paper read at the annual meeting of the American Society of Mechanical Engineers, New York.

Merriman Lauds Committee Work

President of American Society for Testing Materials, in Annual Address, Emphasizes Importance of Technical Society Committees

THAT the work of committees of technical societies is having an ever broadening influence was the keynote of the annual address of president Mansfield Merriman delivered at the nineteenth annual meeting of the American Society for Testing Materials at Atlantic City, June 27-30. Mr. Merriman entered into the history of the society, showing that the members of the first committee were Bauschinger, Tetmajer, Martens and others, whose reports to the International Association for Testing Materials attracted widespread attention. After tracing the work of committees through the first years of the international association, Mr. Merriman continued, in part, as follows:

"It has been a matter of surprise to find, in looking up the history of the American Society for Testing Materials, what a rapid development of committee work took place in those early years. The committee on steel under the efficient direction of its chairman, William R. Webster, introduced indeed those principles and methods which have formed the basis of all work subsequently done. When the society was formally organized in May, 1902, as an outgrowth of the American section of the International Association for Testing Materials, these methods of committee work were adopted and have since been continued with certain modifications and improvements.

Requirements for Efficient Work

"Work is more efficiently done by a committee than by a general meeting of a society because the committee can be constituted of experts who need not waste time on unessentials. The size of a committee is of some importance; when the membership is large it is difficult to secure a satisfactory attendance at meetings and many will not take the trouble to express their opinions in writing. The real work of a large committee is usually done by a few of its members. Maybe about 12 is the number which generally produces the most satisfactory results.

"It is undoubtedly due to corporations and firms that the committee work of the society is conducted so cheaply. Owing to the large volume of their trade it is necessary for companies to make numerous tests and to carry on considerable research, the results of which are freely communicated to committees by their representatives. During the period of two years from Jan. 1, 1914, to Dec. 31, 1915, the total expenses of all technical committees, including joint conferences, were $2,440.16, which is nearly 5 per cent of the total disbursements for all expenses of the society during the same period.

"A word here ought to be said regarding the regulations governing the form of standards, which have now been in force for four years. These relate to arrangement and subdivision, and to typography; also to the terms, spelling, abbreviations, etc., as determined by the most approved practice of engineering societies. The very clear typography and the consistent arrangement of published volumes result from a faithful adherence to these rules.

Establishing a Standard

"After months and perhaps years of discussion a committee formulates the standard which it recommends. Then a letter ballot of the committee is taken and a majority is always in favor of approval. Nevertheless a considerable minority constitutes a force which may perhaps prevent the society from sending the standard out for letter ballot of the entire membership; in fact opposition from members not on the committee has sometimes produced this result. Hence a standard recommended by a committee must be one that has been most carefully considered and which harmonizes all opinions and interests. The letter ballot of the society is, I believe, invariably in favor of adopting the standard recommended by the committee; hence such adoption is of doubtful value unless the members who vote certify that they have carefully considered the matter and regard themselves as fully competent to express approval or disapproval.

"The circulation of our standard specifications, tests, methods and definitions, extends far beyond our membership. Many are copied, in whole or in part, in text-books and reference works. Extracts or abstracts have appeared in periodical literature and in pamphlets issued by producers. They have exerted an influence on the specifications of other societies, especially when joint committees have been constituted. Multiplying the number of copies of each volume by the number of standards therein contained, and adding thereto the number of copies of separate specifications, there is found in round numbers, 304,000 copies in 1913, 353,600 copies in 1914, and 467,300 copies in 1915, or a grand total of 1,124,900 copies of adopted standards printed or issued in three years.

"The influence of our standards upon foreign countries has been constantly growing. In 1913 a special volume containing 20 specifications for steel products was issued, each specification being given in the English, French, German and Spanish languages. Of this volume 500 copies were printed, all of which have been distributed and sold. Also 4,500 pamphlets containing the specifications in the foreign languages were printed. Since our last annual meeting arrangements have been made with the department of commerce by which such standards as have an important bearing on the export trade of the United States will be translated free of expense to the society, be distributed to consular offices throughout the world, and also be made available at moderate prices to American manufacturers and others. This work is now in progress, some 25 or more standard specifications having been already translated into Spanish, and it is expected that translations into the Portugese, French and Russian languages will also be made.

Dangers of Inflexible Standards

"A word of warning may here be uttered against the idea that engineering specifications, methods, tests and definitions can really be made standard in the strict sense of the word, for complete standardization often means stagnation. Standard tools are those which in the same factory allow of no variation, and the expense of altering such tools has been a great obstacle in the adoption of a rational system of measures in this country. Standard methods of testing, widely adopted by manufacturers, may result in certain standard tools for preparing specimens and in standard apparatus for making tests. Thus a material alteration in these may bring an expense upon producers, and hence, on account of the monetary loss apparently involved, many will object to changes which have been demonstrated to be necessary in order to furnish the most reliable knowledge of materials. It seems to me that no standards adopted by this society should be so unyielding that they cannot be altered when the advancement of science so requires. Only physical standards of weights and measures may properly be unalterable as far as possible."

Foundrymen Plan for a Big Week

Local Committees Appointed at Cleveland and Tentative Program Arranged

—Exhibition Will Overflow Into Annex Near Coliseum

THAT the exhibition of foundry equipment and accessories, machine tools, etc., to be held at Cleveland, during the week of Sept. 11, concurrent with the annual meetings of the American Foundrymen's Association and the American Institute of Metals, will surpass in magnitude any similar undertaking, is indicated by the large number of manufacturers who already have made reservation. Fully 90 per cent of the exhibit space in the Coliseum has been disposed of and since 10,000 additional square feet will be required to meet the needs of prospective exhibitors, it has been decided to erect a temporary building on a lot directly across the street from the exhibition hall. At a meeting of the exhibition committee of the American Foundrymen's Association, held at the Hotel Statler, Cleveland, on Saturday, June 24, the erection of this annex was authorized.

The two buildings will be connected by a runway, making it unnecessary for the visitors to descend to the street when passing from one to the other. It is planned to place all of the large operating machines requiring heavy foundations in the temporary structure and it is probable that several different types of melting furnaces will be shown in operation. The annex will be converted into a temporary foundry where molds will be made and poured. Since the Coliseum was erected, many shows have been held in it. It affords 60,000 square feet of floor space, but this industrial exhibition will be the first to overflow its generous dimensions, making necessary the erection of a temporary annex to provide space for all of the manufacturers who contemplate making exhibits. The exhibit will be the biggest and most complete show of its kind ever held in Cleveland and the local interest now manifested points to an unusually large representation of Cleveland products.

Many Reservations Made

Although more than two months still intervene before the opening of the exhibition, 95 manufacturers already have made reservations and the indications are that this total will be swelled to 150 when the doors of the Coliseum and the annex are thrown open on Monday, Sept. 11. At Atlantic City last year there were 102 exhibitors and never before in the history of this exhibition movement has so much space been reserved so far in advance of the opening of the show as this year. The complete list of manufacturers who have made application for space, up to June 24, accompanies this announcement.

The papers and committee reports to be presented at the annual meeting of the American Foundrymen's Association, promise an unusually valuable and interesting program. Separate sessions will be held for the discussion of topics relating to the manufacture of gray iron, steel and malleable castings. The opening meeting will be held at the Hotel Statler, Monday afternoon, Sept. 11. It will be followed by morning sessions only, the convention closing, Friday, Sept. 15. This arrangement will afford the foundrymen more opportunity to inspect the exhibits than has been the case in former years with two ses-

Partial List of Exhibitors at Cleveland

American Gum Products Co., New York.
Arcade Mfg. Co., Freeport, Ill.
Armstrong Cork Co., Pittsburgh.
Atkins, E. C., & Co., Indianapolis.
Ayer & Lord Tie Co., Chicago.
B. & B. Mfg. Co., Indianapolis.
Berkshire Mfg. Co., Cleveland.
Besly, Chas. H., & Co., Chicago.
Birkenstein, S., & Sons, Chicago.
Blystone Mfg. Co., Cambridge Springs, Pa.
Brown Specialty Machinery Co., Chicago.
Carborundum Co., Niagara Falls, N. Y.
Cataract Refining & Mfg. Co., Buffalo.
Chicago Pneumatic Tool Co., Chicago.
Cleveland Blow Pipe & Mfg. Co., Cleveland.
Cleveland Pneumatic Tool Co., Cleveland.
Coale, Thomas E., Lumber Co., Philadelphia.
Curtis Pneumatic Machinery Co., St. Louis.
Daily Iron Trade, Cleveland.
Davis-Bournonville Co., Jersey City, N. J.
Dixon, Joseph, Crucible Co., Jersey City, N. J.
Excelsior Tool & Machine Co., East St. Louis, Ill.
Federal Foundry Supply Co., Cleveland.
Felt & Tarrant Mfg. Co., Chicago.
Foundry, The, Cleveland.
Gardner Machine Co., Beloit, Wis.
General Electric Co., Schenectady, N. Y.
Gibb Instrument Co., Pittsburgh.
Gisholt Machine Co., Madison, Wis.
Goldschmidt Thermit Co., New York.
Graceton Coke Co., Graceton, Pa.
Great Western Mfg. Co., Leavenworth, Kans.
Hardy, F. A., & Co., Chicago.
Harris, Benjamin, & Co., Chicago.
Herman Pneumatic Machine Co., Pittsburgh.
Herold Bros. Co., Cleveland.
Hill-Brunner Foundry Supply Co., Cincinnati.
Hoevel Mfg. Corporation, New York.
Ingersoll-Rand Co., New York.
Iron Trade Review, Cleveland.
Jennison-Wright Co., Toledo.
King, Julius, Optical Co., New York.
Lehigh Coke Co., South Bethlehem, Pa.
Lincoln Electric Co., Cleveland.
Lupton's, David, Sons Co., Philadelphia.
McCormick, J. S., Co., Pittsburgh.
Macleod Co., Cincinnati.
Mahr Mfg. Co., Minneapolis.
Malleable Iron Fittings Co., Branford, Conn.
Manitowoc Electric Implement Co., Manitowoc, Wis.
Midland Machine Co., Detroit.
Moldar Co. (Richey, Browne & Donald), Maspeth, N. Y.
Moltrup Steel Products Co., Beaver Falls, Pa.
Monarch Engineering & Mfg. Co., Baltimore.
Motch & Merryweather Machinery Co., Cleveland.
Mott Sand Blast Mfg. Co., Chicago.
Mumford, E. H., & Co., Elizabeth, N. J.
National Engineering Co., Chicago.
New Haven Sand Blast Co., New Haven, Conn.
Norma Co. of America, New York.
Norton Co., Worcester, Mass.
Obermayer, S., Co., Chicago.
Oliver Machinery Co., Grand Rapids, Mich.
Osborn Mfg. Co., Cleveland.
Oxweld Acetylene Co., Chicago.
Pangborn Corporation, Hagerstown, Md.
Penton Publishing Co., Cleveland.
Pickands, Brown & Co., Chicago.
Portage Silica Co., Youngstown, O.
Pridmore, Henry E., Chicago.
Pyrotectite Co., Chicago.
Robeson Process Co., New York.
Rogers, Brown & Co., Cincinnati.
Sand Mixing Machine Co., New York.
Sly, W. W., Mfg. Co., Cleveland.
Smith Facing & Supply Co., Cleveland.
Smith, R. P., & Sons Co., Chicago.
Smith, Werner G., Co., Cleveland.
Snyder Electric Furnace Co., Chicago.
Standard Sand & Machine Co., Cleveland.
Sterling Wheelbarrow Co., West Allis, Wis.
Stevens, Frederic B., Detroit.
Strong, Kennard & Nutt Co., Cleveland.
Sullivan Machinery Co., Chicago.
Superior Sand Co., Cleveland.
Thomas Elevator Co., Chicago.
Titanium Alloy Mfg. Co., Niagara Falls, N. Y.
Union Steam Pump Co., Battle Creek, Mich.
U. S. Graphite Co., Saginaw, Mich.
U. S. Molding Machine Co., Cleveland.
Wallace, J. D., Chicago.
Warner & Swasey Co., Cleveland.
White & Bro., Philadelphia.
Whiting Foundry Equipment Co., Harvey, Ill.
Woodison, E. J., Co., Detroit.

sions daily, although the length of the program will necessitate several simultaneous meetings.

Three symposiums will feature the program, the subjects of which follow: "The Results of Closer Co-operation between the Engineer and the Foundry as relating to Gray and Malleable Iron, Steel and Non-Ferrous Metals;" "The Influence of Gating on Castings, including Gray and Malleable Iron, Steel and Non-Ferrous Metals," and "Electric Furnace Practice as relating to the production of Steel Castings." Four authors will present papers for each of these symposiums and every phase of these respective subjects will be discussed. Several interesting papers on "Sand Reclamation," also will be presented, covering investigations made among all of the members of the American Foundrymen's Association and by the United States Bureau of Standards. A partial list of papers already promised and the names of their authors,

(*Continued on page* 1433.)

Papers to be Read During Foundrymen's Week

"Sand Reclamation," by H. B. Swan, Cadillac Motor Car Co., Detroit.

"Progress Report on Sand Reclamation," by C. P. Karr, associate physicist, U. S. Bureau of Standards, Washington, D. C.

Symposium on "The Results of Closer Co-Operation Between the Engineer and the Foundry," as relating to

"Gray Iron," by D. W. Sowers, Sowers Mfg. Co., Buffalo.

"Steel," by John Howe Hall, Taylor-Wharton Iron & Steel Co., High Bridge, N. J.

"Malleable Iron," (author not yet determined).

"Non-Ferrous Metals," by C. E. Chase, Modjeski & Angier, Chicago.

Symposium of "The Influence of Gating on Castings," including

"Gray Iron," by B. D. Fuller, Westinghouse Electric & Mfg. Co., Cleveland.

"Steel," by William Gilmore, Hubbard Steel Foundry Co., East Chicago, Ind.

"Malleable Iron," by A. M. Fulton, Fort Pitt Malleable Iron Co., Pittsburgh.

"Non-Ferrous Metals," by R. R. Clarke, Pennsylvania Railroad Co., Pittsburgh.

"The Significance of the Fire Waste," by Franklin H. Wentworth, secretary, National Fire Protective Association, Boston.

"Profit Sharing in the Jobbing Foundry," by C. E. Knoeppel, New York City.

"What the Pratt Institute Has Done, Is Doing and Hopes to Do, in the Training of Men for the Foundry Industry," by Samuel S. Edmands, Pratt Institute, Brooklyn.

"The Installation of Uniform Cost Systems by Members of Technical Societies," by Clinton H. Scovell, Clinton H. Scovell & Co., Boston.

"Report of the Committee on Foundry Costs," by B. D. Fuller, chairman, Westinghouse Electric & Mfg. Co., Cleveland.

"Report of the Committee Advisory to the U. S. Bureau of Standards," by Richard Moldenke, chairman, Watchung, N. J.

"Report of the Committee on Safety and Sanitation," by Victor T. Noonan, chairman, Industrial Commission of Ohio, Columbus.

"Report of Representatives on the Conference Board on Training of Apprentices," by B. D. Fuller, chairman, Westinghouse Electric & Mfg. Co., Cleveland.

Gray Iron Session.

"The Effect of Different Mixtures on the Strength of Chilled Car Wheels," by G. S. Evans, Lenoir Car Works, Lenoir City, Tenn.

"The Manufacture of Semi-Steel Castings," by David McLain, McLain's System, Milwaukee.

"The Use of By-Product Coke in Foundry Operations," by George Long, Pickands, Brown & Co., Chicago.

"How Certain Cleaning Room Problems Have Been Solved," by H. Cole Estep, *The Foundry*, Cleveland.

"The Use of Borings in Cupola Operations," by James A. Murphy, Hooven, Owens & Rentschler Co., Hamilton, O.

"One-Third of a Century in a Gray Iron Foundry," by Alfred E. Howell, Phillips & Buttorff Mfg. Co., Nashville, Tenn.

"The Introduction of Molding Machines in Foundries," by A. O. Backert, Penton Publishing Co., Cleveland.

"The Experimental Foundry," by H. K. Hathaway, Tabor Mfg. Co., Philadelphia.

"Report of Committee on Standard Methods for Coke Analysis," by H. E. Diller, chairman, General Electric Co., Erie, Pa.

"Report of Committee on Standard Specification for Foundry Scrap," by G. E. Jones, chairman, Whiting Foundry Equipment Co., Harvey, Ill.

"Report of Committee on Standard Specifications for Gray Iron Castings," by W. P. Putnam, chairman, Detroit Testing Laboratories, Detroit.

Steel Session.

Symposium on "Electric Furnace Practice for the Manufacture of Steel Castings."

F. T. Snyder, Snyder Electric Furnace Co., Chicago.

A. B. Clarke, Buchanan Electric Steel Co., Buchanan, Mich.

John A. Crowley, John A. Crowley Co., New York.

"Making Electric Steel in the Rennerfelt Flaming Arc Furnace for Foundry Purposes," by C. H. Vom Baur, Hamilton & Hansell, New York.

"Crucible and Electric Steel, Compared" by T. S. Quinn, Lebanon Steel Foundry, Lebanon, Pa.

"Converter and Electric Steel for Casting Purposes, Compared," by Peter Blackwood, Monarch Steel Casting Co., Detroit.

"Manganese Steel Castings," by W. S. McKee, American Manganese Steel Co., Chicago.

"Titanium in Steel Castings," by W. A. Janssen, Bettendorf Co., Davenport, Ia.

"Report of Committee on Steel Foundry Standards," by Dudley Shoemaker, chairman, Atlantic Steel Casting Co., Chester, Pa.

"Report of Committee on Specifications for Steel Castings," by John Howe Hall, chairman, Taylor-Wharton Iron & Steel Co., High Bridge, N. J.

"The Small Open-Hearth as a Flexible Unit for Either Large Steel Foundries or General Jobbing Shops," by Frank Carter, Milwaukee.

"The Presence of Alumina in Steel," by G. F. Comstock, Titanium Alloy Mfg. Co., Niagara Falls, N. Y.

"The Particular Application of Green Sand Molding in the Steel Foundry," by A. F. S. Blackwood, Monarch Steel Casting Co., Detroit.

"Theory and Practice of Heading and Gating Steel Castings," by Ralph H. West, West Steel Casting Co., Cleveland.

"Acid versus Basic Steel for Making Castings," by E. F. Cone, *The Iron Age*, New York.

"Alloy Steel Castings," by David Evans, Chicago Steel Foundry Co., Chicago.

Malleable Iron Session.

"The Application of Malleable Iron Castings in Car Construction," by Frank J. Lanahan, Fort Pitt Malleable Iron Co., Pittsburgh.

"Commercial Side of the Malleable Iron Industry," by W. G. Kranz, National Malleable Castings Co., Cleveland.

"Report of Committee on Specifications for Malleable Iron Castings," by Enrique Touceda, chairman, Albany, N. Y.

Papers will be presented on various subjects relating to malleable iron practice, by the following authors:

Edwin F. Leigh, Marion Malleable Iron Works, Marion, Ind.

S. H. Standish, Northwestern Malleable Iron Co., Milwaukee.

G. Meehan, Ross-Meehan Foundry Co., Chattanooga, Tenn.

Enrique Touceda, Consulting Engineer, Albany, N. Y.

W. A. Forbes, Rockford Malleable Iron Works, Rockford, Ill.

A. H. Chapelka, Chisholm & Moore Mfg. Co., Cleveland.

Will Furnish War Material at Cost

Bethlehem Steel Co. Makes Patriotic Proposal

President Grace Submits Offer to Senate to Permit the Government Itself to Determine the Cost of Manufacture and to Fix Its Own Price for War Munitions

NEW YORK, June 22.—Another patriotic offer to the United States government to furnish war materials at the actual cost of operation plus overhead expenses, interest and depreciation, has been tendered by President E. G. Grace in behalf of the Bethlehem Steel Co., in a letter to Senator Benjamin R. Tillman, chairman of the senate committee on naval affairs. The Bethlehem Steel Co. had previously made a similar proposition to both the house and senate committees on naval affairs at the time when Mr. Grace appeared before these bodies during the hearings on a governmentally owned armor plate plant. The first offer to the senate committee provided that the cost of manufacture be determined by certified accountants satisfactory to the navy department. Subsequently, before the house committee the proposition was broadened, the price settlement to be placed wholly in the hands of the government itself through the federal trade commission. The Bethlehem company now brings the same proposition to the attention of the senate.

Mr. Grace's letter to Senator Tillman again goes thoroughly into the vital points of the armor plate question. The communication, in full, is as follows:

Letter to Senator Tillman in Full

My Dear Sir:

As part of the naval appropriation bill as it comes to the senate from the house of representatives, is a provision to construct a government armor plant at a cost of $11,000,000. This provision is in substance identical with the separate bill passed by the senate for the same purpose, the senate bill itself not having been acted upon by the house. The proposition thus comes before the senate as part of a new bill.

I desire to present to your committee a proposition from my company which had not been made when the senate previously acted on this matter, and which, I venture to hope, may warrant further consideration by the senate:

The Bethlehem Steel Co. will agree, for such period as the government may designate as fully protecting the public interest, to manufacture armor plate for the government of the United States at actual cost of operation plus such charges for overhead expenses, interest, and depreciation as the federal trade commission may determine to be fair.

Our Previous Proposition

When I appeared before your committee some months ago, I proposed that certified public accountants satisfactory to the navy department should inventory our plants and determine the actual cost of making armor; and that with these figures in hand we should confer with the secretary of the navy and agree upon a price mutually satisfactory.

That proposition was objected to by the secretary of the navy on the ground that he did not believe the determination of so important a matter should be left to the personal judgment of any individual happening at the moment to be the secretary of the navy.

After the senate had failed to act upon the foregoing suggestion, I appeared before the house committee on naval affairs, and, in order to make our position still clearer, offered to place the absolute determination of the question of price in the hands of the government itself as represented by the federal trade commission.

It has been suggested that our act was a "death-bed" repentance, as it was not taken until it became apparent that the government would authorize the building of an armor plant, which through government manufacture would destroy the need and therefore the value of our own plant, in which we had invested $7,000,000.

The fact is that we do not for one moment concede that the prices charged for armor in the past have been unreasoanble.

Is it conceivable that we would make the proposition we have done if we were conscious of having been party to any extortion of the government in the past?

Lower Price Offered Repeatedly

We have repeatedly offered to manufacture armor at a lower cost if a larger tonnage should be contracted for. The government has asked for bids from three manufacturers, but its practice has not been to give the contract to the lowest bidder: each year's order has been divided among the three plants, thus making abortive any efforts at competition.

The bureau of ordnance, reporting to the navy department, June 28, 1913, stated that without allowing anything for interest on investment, the probable manufacturing cost of armor produced in a government plant would be as follows:

Output per annum, tons.	Capacity of plant 20,000 tons. Cost per ton.	10,000 tons. Cost per ton.	5,000 tons. Cost per ton.
20,000	$279	$349	$400
10,000	...	314	394
5,000	...	...	354

The bureau estimated that if interest on investment were to be added, the sum of $49 per ton should be added to the foregoing charges on a plant of 10,000 tons capacity.

Our plant has 12,000 tons capacity, and the average annual amount since 1887 which we have been asked to supply to the government has been only 3,280 tons, or a little over 25 per cent of capacity. The average cost to the government for the armor so supplied has been $432.62 per ton.

It is obvious that the cost to be borne by each ton for overhead, interest, etc., increases as the annual output is reduced. Therefore, accepting the government's own figures, with a capacity such as we have, operating at less than one-third its capacity, the production cost in a government plant, without allowance for interest, would have been much greater than the $432.62 which we were paid.

Our new proposition is not a "death-bed repentance," it is a re-

newed effort to make clear to the government and to the public, that we seek only what is absolutely fair. Our proposition is made in complete confidence that thorough consideration by a competent and impartial tribunal will establish two facts:

1.—That our policy and prices in the past have been reasonable; and

2.—Such are the economies that we can effect in the manufacture of armor in connection with our other products that under present conditions we can manufacture for the government cheaper than the government can possibly do so for itself.

Taking the Profit Out of War

It is said that a government plant should be built "to take the profit out of war."

Our company has no inclination to make capital out of the military necessities of the United States. In the event of war or threatened war, all the facilities we have for any purpose are at the disposal of the United States government upon its own terms. That means not only our armor plant; it includes our commercial plant, and our ordnance-making facilities. We have urged no program of preparedness; we desire only to be able to serve the government as we may be called upon.

Our armor plant was built at the request of the government of the United States. That request has, by the implicit action of successive secretaries of the navy, been frequently renewed.

The situation in brief, as we see it, is as follows:

1.—Figures compiled for your committee have shown you that the United States has for the past 20 years obtained armor plate at a price materially less than that paid by any of the great naval powers, while our labor costs were and are higher than those prevailing in any other country.

2.—The navy department has repeatedly testified that the quality of armor supplied for these reduced prices was better than the armor made for the navy of any other nation in the world.

3.—The existing prices of material and labor are very much higher than was the case when the estimate was made that the proposed government plant of 20,000 tons capacity could be built for $11,000,000. Our experience indicates that the cost now will be fully $15,000,000, and probably more.

4.—The naval lessons of the present war remain to be learned. What they shall teach with reference to armor and the relative value of projectiles and armor is still to be seen. Under no conditions can an armor plant be built in less than three years. Thus the problem to be faced in the manufacture of armor may be absolutely different by the time the plant could possibly be ready for use.

5.—The private armor-making capacity in this country was brought into existence at the behest of the government. In these three plants some $20,000,000 has been invested.

What We Urge

Under the foregoing circumstances, we respectfully ask your committee to reconsider its former recommendation on this subject and to bring to the attention of the senate these considerations:

1.—That all purposes of the United States government will be served if the federal trade commission is empowered to determine the price and the navy department the quality of the armor which shall be manufactured for the use of the United States government.

2. That until, under the foregoing conditions, the existing capacity of armor plants built for and at the request of the government is utilized, it will be unfair to private manufacturers for the government to take action which will in effect confiscate their property.

3.—That until the naval lessons of the present war in Europe have been disclosed, and until a practical effort has been made to obtain armor from private manufacturers under the conditions named, the government should not proceed with the expenditure of the public money necessary to construct an armor-making plant.

This question should not be determined with reference to the interests of the Bethlehem Steel Co., but with supreme regard for adequate national defense and sound public policy.

Our company asks no favors; we only ask that the government thoroughly ascertain what the facts are, and then look those facts frankly in the face. If the facts are found to be as we have stated them, and are seen to be as advantageous to the government as we believe them to be, we respectfully ask the government to do what it finds to be fair to us.

As you are aware, we maintain no "lobby" in Washington to urge our views on this or any other matter. We have sought and are seeking to present our views of this measure in the frankest and most public way we can devise. In keeping with our policy, we shall, therefore, take the liberty of giving this letter to the press, as well as make such other distribution of it as will bring it adequately to the attention of the public. If your committee desires further information, I shall be very glad to appear before you and give you all details in my power. We only ask that you give us a fair chance before you take steps to cripple our industry.

Very respectfully,

E. G. GRACE, President.

Foundrymen Plan for a Big Week

(*Continued from page* 1431.)

appears on page 1431 of this issue.

To provide for the entertainment of the visiting foundrymen and to direct them in plant visitation, local committees have been organized, the chairmen of which held their first meeting at the Hotel Statler, Cleveland, on Saturday, June 24. F. B. Whitlock, Interstate Foundry Co., has been appointed chairman of the general directing committee which consists of the chairmen of the other committees, as follows: Plant visitation, J. S. Smith, Smith Facing & Supply Co.; Entertainment, Sterling Hubbard, Rogers, Brown & Co.; Reception, Herbert Boggis, Taylor & Boggis Foundry Co.; Golf, W. B. Greene, Palmer & De Mooy Foundry Co.; Finance, J. C. Brainard, Johnston & Jennings Co.; Ladies' entertainment, Mrs. W. C. Sly. The various committees are all residents of Cleveland.

An unusually complete entertainment program is being outlined, which includes the annual banquet of the American Foundrymen's Association and the American Institute of Metals, at the Hotel Statler, Thursday evening, Sept. 14. Every opportunity also will be afforded for the plant visitation. Cleveland is one of the leading foundry centers of the United States, and practically all of the casting manufacturers will permit the inspection of their plants during convention week.

In view of the great activity prevailing in the foundry industry, making necessary the almost continuous service of every available employe, many foundry operators are planning the vacation of their plant executives for convention week. That the attendance will eclipse all previous records is indicated by the interest already manifested and large delegations of foundrymen will travel in special cars from Detroit, Pittsburgh, Chicago, Milwaukee, Buffalo and Philadelphia. Many foundrymen will motor to the convention, taking advantage of the excellent brick roads radiating from Cleveland.

Business News of Nation's Capital

Prominent Manufacturers and Engineers Protest Against Anti-Efficiency Legislation—Doubt as What President Will Do

Bureau of *The Iron Trade Review*,
206 Corcoran Bldg.,
Washington, June 27.

The direct influence of President Wilson is probably the only thing that can defeat the efforts of organized labor to abolish scientific shop management in government establishments. Whether or not the President will exert his influence in this direction remains to be seen. The issue has been put squarely before him. He was called upon last Wednesday by a delegation of 30 prominent manufacturers, engineers and business men who protested to him against legislation inserted and proposed in pending measures before congress to do away with the efficiency system in government arsenals, navy yards and the post office department. These measures are in the nature of riders intended to carry out the designs of the Tavenner bill, which would prohibit government officials from employing the efficiency system. The President, it is understood, did not commit himself to the delegation either for or against the pending legislation. The delegation was in conference with him for about half an hour, when the question was discussed rather fully. The fact that two of the President's cabinet officers, Secretary of War Baker and Postmaster General Burleson, have gone on record in opposition to the legislation may or may not cause him to ask that it be killed.

Those constituting the delegation were: Morris L. Cook, Philadelphia; E. B. Passano, Baltimore; Allen M. Cook, Norfolk, Va.; Wilfred Lewis, Philadelphia; John Driscoll, Watertown, Mass.; H. P. Kendall, Norwood, Mass.; D. Kirschbaum, Philadelphia; W. R. Whitney, Schenectady, N. Y.; J. L. Sydner, Akron, O.; H. D. Minich, Boston; W. B. Richards, New York; C. Wood Walter, Cincinnati; W. A. Viall, Providence, R. I.; J. Utz, Cleveland; H. A. Goddard, Cleveland; F. J. Miller, New York; H. H. Rice, Indianapolis; Oberlin Smith, Bridgeton, N. J.; E. A. Nuller, Cincinnati; Donald Tulloch, Worcester, Mass.; F. C. Lawton, Detroit; Howard E. Coffin, New York; Boyd Fisher, Detroit; Messrs. Lodge, Cincinnati; Alford, New York; Alden, Higgins and Newton, Worcester, Mass.; Nathan B. Williams, Washington, D. C., and F. B. Copley, New York.

Mr. Cook, former director of public works at Philadelphia, headed the delegation. With others of the delegation, he told the President that some of the much attacked efficiency devices made for industrial preparedness.

"In industrial operations, the stop watch has a large place," he said. "To forbid its use would be like keeping a carpenter without a foot rule. When properly used, it is only the harbinger of increased prosperity for the workers."

Last week, the house voted favorably, 197 to 115, on an amendment to the fortification appropriation bill which would do away with the Taylor system at the Watertown arsenal. The amendment was offered by Mr. Tavenner, and is similar to one previously passed by the house and carried in the naval appropriation bill. It seems certain the house will vote to adopt the amendment to the army appropriation bill. The vote on the amendment in connection with thte fortifications bill was significant in one way at least. Practically all of the prominent Democrats of the house, some of them chairmen of important committees,voted against the rider. Among them were Majority Leader Kitchin, Representative Sherley, who had charge of the fortifications bill; Representative Hay, chairman of the committee on military affairs and Representative Flood, chairman of the committee on foreign affairs. The vote was of a nonpartisan character, although a big majorty of those supporting the amendment were Democrats. The number of votes against the amendment was larger than many thought it would be. It is taken to indicate the possibility, if not probability, of defeating this legislation in the future. It was never opposed by an organized effort until this year, and the campaign against it has made a good showing, considering all elements, political and otherwise, which give strength to this kind of legislation.

While it is understood that about 30 members of the senate are openly against anti-efficiency legislation, the attitude of some members of that body is not known. On the other hand, the position of others is known to favor the legislation. Indications are that, unless the President goes on record against the riders, they will pass the senate by a large vote. The upper house as now constituted is considered by many to be more radical than the lower branch of congress. There are some conservative members of that body, however, who favor the elimination of the use of the stop watch, among them being Senator Lodge.

Armor Plate Tonnage

Washington, June 27.—Senator Tillman, chairman of the committee on naval affairs, has taken no action on the new proposition submitted to him by the Bethlehem Steel Co., through a letter signed by President E. G. Grace, by which the company offers to supply the government with armor plate at actual cost of operation plus such charges for overhead expenses, interest and depreciation as the federal trade commission may determine to be fair. In view of Mr. Tillman's refusal to consider other liberal offers made by the company to manufacture armor plate for the government, it is considered improbable that he will give serious consideration to the latest proposal submitted. The senator told *The Iron Trade Review* that he had not called the attention of the committee to Mr. Grace's latest proposal.

The building program as recommended by the senate subcommittee to the full committee on naval affairs provides for four dreadnaughts and four battle cruisers for the coming fiscal year. This would call for practically 46,000 tons of armor, by far greater than any tonnage manufacturers have ever bid on. It exceeds by about 16,000 tons the annual combined capacity of the three armor making plants in the United States.

Large Loss.—Plants of the Liquid Carbonic Co. and the British-American Chemical Co., Pittsburgh, were almost totally destroyed by fire, June 23. The fire originated above the boiler room in the Carbonic plant and spread to the works of the British-American company, which adjoins the Carbonic company's property. The total loss is estimated at about $400,000.

Iron and Money: Fact and Comment

Business Sentiment Calm as Mexican War Cloud Threatens—Iron and Steel Stocks Sell Lower as Break Seems Imminent

THE critical stage of our relations with Mexico has overshadowed all other considerations in the financial markets. Stock prices have been more or less unstable in the face of the mobilization call, but not much significance has been attached to this in financial and industrial circles. Business sentiment has remained calm in spite of the contingency of several years of warfare with Mexico. While it is generally believed that Mexico would face a hopeless task to finance a conflict of any length, it is realized that too much hope should not be hung on this thread. The ability to fight long wars without ostensible means of support is one of the paradoxes of history. Iron and steel stocks have been marked down more drastically than any other class of securities, save those of corporations doing business in Mexico. Declines ranging from a fraction in the case of United States Steel common to over four points in Lackawanna Steel took place last week. General trade, however, continues abnormally large in practically all lines of industry. While high prices may have checked consumption to some extent, trading is unusually active for the time of year. Constructive developments still predominate in the business world.

Following is a table comparing quotations of iron and steel stocks on the New York stock exchange at the close of business June 24.

	Close June 24.	Net chg.
American Can	53½	—2¾
American Can prfd.	109⅝	— ⅜
Amer. Car & Fdy.	56¾	—2½
Amer. Car & Fdy., prfd.	116⅞	+ ½
American Locomotive	68⅜	—2⅞
American Locomotive, prfd.	102½	.....
American Steel Foundries	47	—4
Baldwin Locomotive	80¾	—7⅜
Baldwin Locomotive, prfd.	104	—1½
Bethlehem Steel	444½	—1½
Colorado Fuel & Iron	41¼	—2⅜
Continental Can	98	+ ¼
Crucible Steel	78¼	—5½
Crucible Steel, prfd.	114⅜	—1⅜
General Electric	166	—3½
Gulf States Steel	83	—2¼
Gulf States Steel, 1st prfd.	96	— ¼
Gulf States Steel, 2d prfd.	88	—1½
Internat'l Harv. of N. J.	113⅛	+ ⅜
International Harv. Corp.	80	—2
Lackawanna Steel	66¼	—4¾
Nat'l Enamel. & Stmp. Co.	24¼	— ¼
Pressed Steel Car	47½	—1⅞
Pressed Steel Car, prfd.	99½	—1
Pullman Palace Car	163	—1
Republic Iron & Steel	44⅜	—2½
Republic Iron & Steel, prf.	107½	+ ⅛
U. S. Cast Iron Pipe & Fdy.	20½	—1½
United States Steel	84	—1⅛
United States Steel, prfd.	117⅛	— ½
Westinghouse Mfg.	58⅜	—2⅜

Following is a table which shows the price changes in certain leading iron and steel securities which are not listed on the New York stock exchange:

	June 23.	June 16.
American Radiator	398	395
American Ship Building	45	46
Cambria Steel	...	83⅛
Chicago Pneumatic Tool	72	74
LaBelle Iron Works	...	51
Lake Superior Corp'n.	11¼	12
Stewart-Warner Speed. Co.	102	105
Warwick Iron & Steel	9¼	9¾
Westinghouse Air Brake	145	145
Westinghouse Elec. & Mfg.	61	63¼

Financial Crop Ends

The Stewart-Warner Speedometer Co. has voted to retire the remaining $720,000 outstanding preferred stock of the corporation Aug. 1 at 110. The company has $10,000,000 common stock and no bonds.

* * *

Following the annual stockholders' meeting of the Kokomo Steel & Wire Co., Kokomo, Ind., last week, it was announced that the company's profits for the year were in excess of $600,000. No change was made in the personnel of the officers or board of directors.

* * *

Charles Morse, of Montpelier, Ind., receiver of the Jackson Shovel & Tool Co., last week filed a petition in the Blackford circuit court at Bluffton, Ind., asking permission to sell the property, which was thrown into receivership recently on complaint of the R. Channon Co., Chicago, the principal creditor.

* * *

The utilization of considerable capacity available in the former plant of the defunct Wisconsin Engine Co. at Corliss, Racine county, is presaged by the filing of articles of incorporation by the Corliss Motor Truck Co., with a capital stock of $100,000. The Corliss plant has been idle for more than three years, or since the Wisconsin Engine Co. went into bankruptcy early in 1913.

* * *

The Scovill Mfg. Co., Waterbury, Conn., has declared an extra dividend of 10 per cent in addition to the regular quarterly dividend of 2 per cent, both payable July 1 to stock of record June 24. This makes 52 per cent which the company has paid in dividends thus far this year. In April and May extra dividends of 10 per cent each were paid. In March an extra was 8 per cent and in January and February 5 per cent each.

* * *

The Pittsburgh By-Product Coke Co. has been incorporated in Delaware with a capital stock of $10,000,000 to operate plants for the manufacture of coke and other by-products from coal. The company is controled by the H. Koppers Co., Pittsburgh, and its stockholders. The company will operate the Seaboard By-Product Coke Co., Jersey City, N. J., and the Minnesota By-Product Coke Co., St. Paul.

* * *

President Mark Workman, of the Dominion Steel Corporation, Sidney, N. S., outlined the future policy of the company at the annual meeting of stockholders this week, advocating modernizing the steel plant. The board of directors was re-elected. George Caverhill was added to the executive committee. There are now three vice presidents, William McMaster, of Montreal, and Sir Henry Pellatt and Col. Frederick Nicholls, of Toronto.

* * *

In the bankruptcy proceedings against the Milwaukee Motor Co., Milwaukee, Wis., an order has been filed declaring a third dividend of 20 per cent, amounting to $53,598, to creditors; a 100 per cent dividend on wage claims, amounting to $7,179, and a 15 per cent dividend on unsecured claims, amounting to $2,068, a total disbursement of $62,847 at one time. The first dividend to creditors was 10 per cent and the second 5 per cent. There is $15,000 available, final settlement being delayed by consideration of a claim for $13,062 by A. G. Farmer, Detroit.

* * *

The Cincinnati Screw Co., Twightwee, O., manufacturer of screw machine products, through its president and treasurer, B. B. Quillen, advises it has increased its capital stock to $200,000, of which $100,000 is cumulative 7 per cent and $100,000 common. The company's plant is being operated night and day and is growing rapidly. Orders have been placed for large quantities of machine tools, including Browne & Sharpe, Gridley, Cleveland and Hayden Automatic screw machines, multiple and semi-automatic drill presses, nut tappers, engine lathes, etc.

* * *

Increased layout to plant equipment in order to enable the company to handle a contract for munition shells, is assigned as the cause for the appointment of a receiver for the Santo Mfg. Co., Philadelphia, conducting a general machinist business. Some months ago the company received a contract for finishing 150,000 3-inch shrapnel shells and it added a large amount of machinery to its plant for carrying on this work. Lack of working capital finally brought about the appointment of a receiver. It is stated that the plant and assets of the company are in excess of the indebtedness but that immediate cash is necessary. Kern Dodge, the receiver, has been directed by the court to execute such orders as are on hand.

Europe Wants Ship Building Tools

Domestic Market is Active But Slump in the Near Future is Predicted—Crane Demand is Strong

A LARGE AMOUNT of business continues to feature the machine tool market. The most favorable factor of the week has been a marked improvement in the export demand. England, France, Italy, Russia and Spain all have placed comparatively large orders and continue in the market. The requirements of these countries involve the general run of machine tools, and particularly such equipment as is required in ship building. In addition to the countries mentioned, business has come from other foreign sources. For instance, a good order for repair shop equipment came from Honolulu. There is a small inquiry in the market from Japan. The domestic demand is featured by some good-sized transactions, but some machine tool sellers say the indications are that general domestic requirements are becoming less urgent and that a shrinkage in the volume of this business would not prove a surprise. The General Electric Co. is one of the more important buyers at present. This company placed orders for nine boring mills, ranging from 4 to 12 feet. It continues in the market for a large number of lathes, shapers and miscellaneous tools on which quotations already have been received. The Sun Ship Building Co., Philadelphia and Chester, Pa., has placed the largest order for punching and shearing machinery which, it is believed, ever has been awarded at one time. This business went to a Delaware builder. The Sun company already has bought some of its general machine shop equipment and is expected to place the remainder shortly. The Keystone Watch Case Co., Riverside, N. J., continues a large buyer of equipment for making time fuses. The board of education, Essex county, N. J., has placed an order for eight or nine machine tools for a school in East Orange, N. J. The Plainfield, N. J., board of education also recently placed orders for considerable equipment. Further vocational school requirements are expected to develop in the east shortly. The Midvale Steel & Ordnance Co., Philadelphia, which has been a large buyer of late, continues to purchase additional equipment. Railroad business is of steadily-diminishing proportions. The Baltimore & Ohio has placed some equipment, but outside of this, there is no business of importance from the carriers. Action on the Grand Trunk list continues to be reserved, apparently, for the indefinite future. The Southern Pacific also has held up action in regard to the list on which it recently took prices.

The crane market is featured by much activity. The Carpenter Steel Co., Reading, Pa., has placed eight cranes with the Cleveland Crane & Engineering Co. The Pennsylvania Steel Co. bought a 25-ton Alliance crane; this concern has decided not to buy the two 100-ton cranes for which it recently inquired, but expects to take action on the other, four in number. The Maryland Steel Co. bought a 5-ton wall crane; it also purchased two 10-ton cranes from the Morgan Engineering Co. The Lukens Iron & Steel Co., Coatesville, Pa., has purchased several Morgan cranes. The Worth Bros. Co. plant of the Midvale Steel & Ordnance Co., Coatesville, Pa., is in the market for seven additional cranes, ranging from 5 to 50 tons in capacity. The Baltimore & Ohio has revived an inquiry for a large gantry crane for its Baltimore wharves. The Phoenix Bridge Co., Phoenixville, Pa., is in the market for three 10-ton cranes. The Pennsylvania railroad is in the market for a 40-ton gantry crane for Olean, N. Y., and for a large gantry for Greenville, N. J.; this road has decided to buy the two 100-ton 6-motor cranes for its Altoona shops, on which it took bids some time ago.

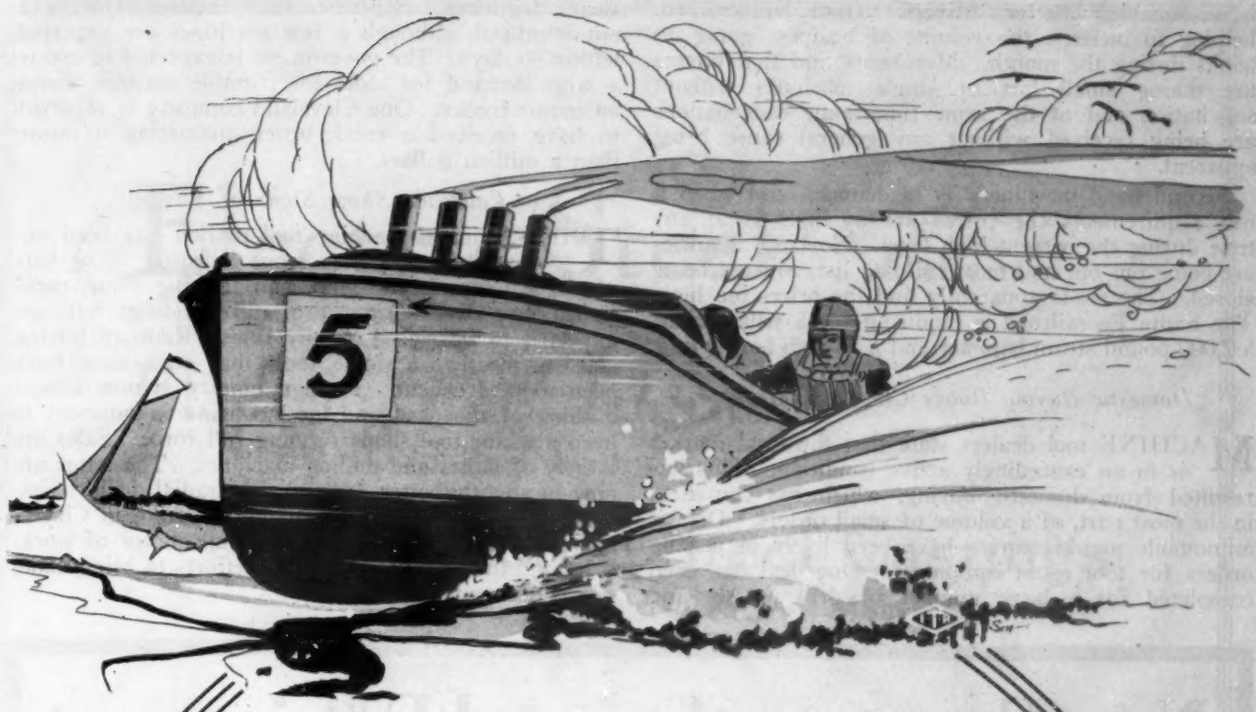
Samuel L. Moore & Sons Corporation, Elizabeth, N. J., has let the structural contracts for a large plate and angle shop and a forge shop. Philbrick, Booth Foundry Co. will build a new foundry in Hartford, Conn. New London Ship & Engine Co., Groton, Conn., will build another large addition. American Steel & Wire Co., Worcester, Mass., is about to build a large machine shop addition. Duckworth Chain & Mfg. Co., Springfield, Mass., will erect an extension. Kerr Turbine Co., Wellsville, N. Y., is about to build a blacksmith shop. Fore River Ship Building Co., Quincy, Mass., will build a large new pattern and joiner shop. General Electric will build a large wire and cable addition at Schenectady, N. Y. Ford Motor Car Co. has retained Albert Kahn, Detroit, to draw plans for a $1,000,000 plant to be erected at Kearny, N. J. Wm. Bartley & Sons, Bartley, N. J., will build a foundry and machine plant to replace that burned recently. National Lock Washer Co., Newark, N. J., will build a rolling mill. Cortland Foundry & Machine Co., Cortland, N. Y., has let the structural contract for a foundry and machine shop. Corona Typewriter Co. will build a large plant at Groton, N. Y. Habirshaw Electric Cable Co. will build a big addition to its plant at Yonkers, N. Y. Acme Pattern & Machine Co., Buffalo, is about to extend its capacity. Sizer Forge Co., Buffalo, will build a large plant for producing large forgings, such as stern frames for vessels; the plant will include an open-hearth furnace. Meekers Union Foundry, Norwalk, Conn., is extending its capacity by 50 per cent.

Coal Operators Aid Pittsburgh Market

DEMAND for machine tools and rolling mill machinery is more general in the Pittsburgh market. Nearly all the leading steel manufacturers have been figuring in the market for single tools. Coal mine operators are buying rather heavily. The Westinghouse Airbrake Co., which recently took an order for 1,100,000 brass time fuses, is not expected to buy any additional equipment at this time. The Pressed Steel Car Co. has received an order for 100,000 forgings for 9.2-inch shells for Great Britain and may buy some machinery for this work. No new inquiries for rolling mill equipment have come out for several days. Builders of cranes, unable to promise delivery for several months, are not attempting to develop any additional inquiries.

Better Deliveries Aid Chicago Market

THE machine tool market in Chicago presents the peculiar situation of a fair volume of sales without active inquiry. June probably will not show as large a volume of business as preceding months, which



THE unusual construction of a high speed Marine Engine, in which reliability must be secured with as little weight as possible, gives "AGATHON" Steels a splendid opportunity to show up to advantage.

"AGATHON" Steels are for just such purposes, and the fact that they are in such demand is proof enough that they make good.

AGATHON STEELS

"AGATHON" Chrome Nickel
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Our shipping facilities are favorable to speedy delivery anywhere

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MASSILLON, OHIO

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Cleveland Office: Hickox Bldg., The Hamill-Hickox Co., District Representative
Chicago Office: Room 1511-12 Lytton Bldg., 14 East Jackson Blvd., A. Schaeffer, District Representative
Philadelphia Office: 902 Widener Bldg., Frank Wallace, District Representative

is seasonable. Better deliveries from builders are helping to increase the volume of business going on books during the month. Merchants find that buyers are taking small lots or single machines without solicitation and at the same time some cancellations are being received without any general cause being apparent.

Second hand machinery is in demand, and when it fills requirements the prices are as high as at any time during the present high level. No large inquiries are being put out and most railroad lists are not being closed. The roads apparently find the prices too high. The Santa Fe railroad is inquiring for a wheel lathe, a 2,000-pound steam hammer and a 54-inch boring mill.

Domestic Buying Buoys Cleveland Market

MACHINE tool dealers state that the local market is in an exceedingly active condition. This has resulted from domestic buying, which has consisted, in the most part, of a volume of small orders. Detroit automobile manufacturers have been lively in placing orders for tool room equipment. One deal has been completed for a large number of drill presses and steam hammers. Deliveries to Cleveland firms have not improved, although a few machines are expected within 90 days. The government is expected to create a large demand for tools for portable machine shops on motor trucks. One Cleveland company is reported to have received a truck order amounting to more than a million dollars.

Railroads Show Signs of Buying

THE Cincinnati machine tool market has been encouraged by inquiries from railroads. The lists of the Chesapeake & Ohio, and the Big Four, mentioned two weeks ago, are still pending, but are expected to be closed at any time. Railroad buying consists mostly of single tools, but such sales have been more frequent. Foreign inquiry is now almost a thing of the past, and local demand is sufficient to keep machine tool shops running full force. Sales are largely of lathes and milling machines. The latter are now in slightly better demand than radial drills. Employers now consider the machinists' strike in Cincinnati at an end, as all shops have full quotos of workmen, and the union is making no efforts to bring about new developments.

New Construction and Equipment

What it is **Where it is** **Who's doing it**

Among New England Factories

AUBURN, ME.—The Cushman-Hollis Co. has awarded a contract for a brick, mill-construction, fireproof, 4-story and basement addition to its factory and a fireproof, 40 x 58-foot boiler house and coal pocket at Union and Court streets, to cost $100,000.

RUMFORD FALLS, ME. — The Maine Coated Paper Co. has awarded a contract to the H. P. Cummins Construction Co., Ware, Mass., for a brick, fireproof 1 and 2-story, 200 x 200-foot addition to its paper mill to cost $100,000.

THOMASTON, ME.—Plans are ready to figure for a brick, steel and concrete, fireproof, 2-story, 57 x 75-foot addition to the state prison to cost $50,000.

BOSTON.—The Massachusetts Copper Casting Co. has been incorporated with $10,000 capital by M. E. Thomas, Thomas Wilson and Robert J. Holmes.

BOSTON.—The American Web Co. has been incorporated to make machinery. The new company is capitalized at $30,000 by Willard A. Paul, Herbert A. Ward, John C. Ward, Leonard T. Ward and George M. Wilder.

CAMBRIDGE, MASS.—The Boston Woven Hose & Rubber Co. has awarded a contract to the Stone & Webster Engineering Corporation, for a reinforced concrete, 4-story and basement, 65 x 322-foot factory on Fulton street.

MANSFIELD, MASS.—Plans are being prepared for a brick, mill-construction, 4-story and basement, 60 x 150-foot addition to cost $50,000, for the S. W. Card Mfg. Co., manufacturer of taps and dies.

MILTON, MASS.—The town of Milton will build a brick, fireproof, 3-story addition to the Vose grammar school, to cost $175,000.

QUINCY, MASS.—The Alhambra Theater Co. will build a brick, stone and steel, fireproof, 2-story, 57 x 198-foot theater and office building to cost $40,000.

RUSSELL, MASS. — The Westfield River Paper Co. has been incorporated with $650,000 capital by Philip L. Saltonstall, James S. Alexander and M. B. Wheeler, all of Boston. The company will take over the plant of the Russell Falls Paper Co., and may also build a new plant.

SPRINGFIELD, MASS.—The United Electric Light Co. has awarded a contract for a brick, steel and concrete, 90-foot high, 77 x 110-foot power house and a brick and steel, 5-story, 40 x 90-foot storehouse on Bliss street, to cost $250,000.

NEW BRITAIN, CONN.—Plans will be ready about July 10 for a brick, mill-construction, 6-story and basement, 40 x 114-foot addition to the factory of the Beaton & Cadwell Mfg. Co. on Main street.

NEW BRITAIN, CONN.—Plans will be ready about July 10 for a brick, concrete and stone, fireproof, 2-story, 120 x 155-foot, 24-room school at Lee, North and Clark streets for the city of New Britain, to cost $125,000.

STRATFORD, CONN. — The Bridgeport Steel Treating Co. has been incorporated with $50,000 capital by W. J. Bantley, F. R. Barron, Mathew Corbett and Mathew Corbett Jr.

From the Alleghenies to the Sea

BROOKLYN, N. Y.—The S. H. W. Motor Car Co. has been incorporated to manufacture cars, engines and machinery. The new concern is capitalized at $20,000 by R. A. Hill, F. G. Wilcox and L. C. Smith, 84 William street.

NEW YORK.—The Anthony Mfg. Co. has been incorporated to manufacture copper, iron, steel and other metal products. The new company is capitalized at $250,000 by W. P. Brew, L. S. Wells and J. E. Rodgers, Flanders hotel, New York.

NEW YORK.—The Eagle Machine Tool Co. has been incorporated with $10,000 capital by J. Solomon, M. Spokony and P. E. Schlemp, 217 East Eighty-ninth street.

NEW YORK.—Plans have been filed for erecting a 9-story building to cost $250,000 at 62-64 West Tenth street for Hyman Schroeder W. L. Rose and L. A. Goldstone, architects, prepared the plans.

NEW YORK.—The Senter-Robbins Metals Co. has been incorporated with $10,000 capital by H. Edwards, L. Robbins and S. J. Senter.

NEW YORK.—Dreyfus Bros. have been incorporated to deal in auto supplies, bridge work, appliances, machinery, etc. The new firm is capitalized at $10,000 by A. C. & L.

Electric Steel

For Immediate Delivery

Electric Steel Ingots

500 TONS Per Month

Electric Steel Castings

300 TONS Per Month

Alloy Steel Castings or Ingots Made to Specifications

THIS is your opportunity to contract for your requirements of Steel Ingots or Castings. The output of our new Electric Steel Plant, which has just been completed and placed in operation, has not yet been contracted for.

The plant is equipped with a Three-Ton Heroult Electric Furnace and is the outgrowth of our crucible steel casting business.

Our organization is trained in electric steel production and steel casting manufacture and we can guarantee a product of the highest quality.

Send Us Your Specifications

Racine Steel Castings Co.

RACINE, WIS.

Owned and operated by the

Belle City Malleable Iron Co., Racine, Wis.

Dreyfus, Thirty-first street and Broadway.

PORT JEFFERSON, N. Y.—The Wetzel Mechanical Stoker Co. has been incorporated with $50,000 capital to manufacture hardware and to operate a foundry. The company is incorporated by T. M. McGrath, C. S. Yawger and F. C. Williams.

TOTTENVILLE, S. I., N. Y.—The Tottenville Copper Co. has filed plans for erecting a 30 x 120-foot addition.

ATLANTIC CITY, N. J.—A 23-story annex will be built to the Hotel Traymore on Illinois avenue at a cost of $2,500,000.

BAYWAY, N. J.—The Waclark Wire Co. will add three buildings to its plant to cost $110,000. One structure will be a mill, 63 x 290 feet at Bayway and South Front street, another will be an office building, 57 x 82 feet, and the third will be a machine and carpenter shop, 52 x 141 feet.

HACKENSACK, N. J.—Acker & Lyle, Inc., has been incorporated to manufacture automobiles with $125,000 capital, by Franklin Acker, Tredwell K. Lyle, M. C. Lyle and A. W. Acker.

NEWARK, N. J.—Barrett & Co., 42 Johnson street, will erect a 3-story manufacturing plant. 49 x 95 feet to cost $14,700.

NEWARK, N. J.—The Public Service Electric Co. has taken out a permit to erect a large addition to its Point-No-Point power house. It will comprise a 5-story, brick and steel building, store rooms and a coal bunker machine. The improvements will cost about $150,000.

NEWARK, N. J.—The American Synthetic Dyes Co., avenue R and Newark Transfer, will build a 1-story concentration building to cost about $22,000.

NEWARK, N. J.—The Hartig Standard Gas Engine Co. has been incorporated to manufacture motors and engines. The new company is capitalized at $10,000 by Eyre Switzer, Horace C. Grize, M. F. Switzer, Newark.

PHILADELPHIA. — John T. Windrim is preparing plans for a power house to be erected in Chester, Pa., for the Beacon Light Co. at a cost of about $1,000,000.

PHILADELPHIA. — Plans have been filed for a 220 x 540-foot brick, steel and concrete, ordnance machine shop to be erected for the Midvale Steel & Ordnance Co. at a cost of about $320,000.

PHILADELPHIA. — The Philadelphia Ship Repair Co. has purchased 15 acres along the Delaware river at Mifflin street and will use it as a site for additions to its plant. The company will construct a floating dry dock, will install new machinery and will make other improvements.

POTTSTOWN, PA.—Louis Allen Abramson, architect, 250 Fifth avenue, New York City, is taking bids on the erection of a brick, 5-story, 46 x 60-foot factory building for the S. Liebovitz & Sons Co., 75 Leonard street, New York City.

SCOTTDALE, PA.—Bids are being taken for the erection of a main building for the Mauch Chunk Foundry, capitalized at $60,000.

SCOTTDALE, PA.—The commissioners of Lycoming county have been directed to erect a bridge over the west branch of the Susquehanna river at Montgomery at a cost of $150,000.

SCRANTON, PA.—Davey & Crostler, architects, Coal Exchange building, are taking bids on the construction of a brick, steel and reinforced concrete, 4-story, 50 x 75-foot printing plant.

DOVER, DEL.—The Lewen System, Inc., has been incorporated to manufacture, sell and deal in steel, iron and other metals used for construction purposes. The new company is capitalized at $1,000,000 by William P. Savage, Robert H. Robers and Richard J. Adams, all of New York.

DOVER, DEL.—The International Pulverized Fuel Corporation, New York, has been incorporated as a mechanical engineer and to manufacture gas producers. The new company is capitalized at $100,000 by V. Z. Caracristi, H. F. Ball, Bronxville, N. Y.; G. L. Bourne, Mamaroneck, N. Y.; S. G. Allen, New York City, and others.

Activities in the Central States

AKRON, O.—The Supreme Rubber Co. has been incorporated to build and operate a factory in Akron. The company is capitalized at $25,000 by Chester A. Teits and Dan Zeisloft.

CANTON, O.—The Hinderer Brothers Co., recently incorporated as patternmaker, and founder, will begin to erect a foundry and pattern factory at Maple avenue and the Wheeling & Lake Erie railroad tracks.

CLEVELAND. — The Steel Products Co. has been incorporated with $4,000 capital by J. C. Royon, Elliott E. Stearns, John A. Chamberlain, Clarence H. Royon and M. T. Gorton.

CLEVELAND.—Sealed bids will be received at the office of the commissioners of purchases and supplies, new city hall, until noon July 6, for 30 and 36-inch, riveted steel pipe to be used at West Sixty-fifth street and the N. Y., C. & St. L. railroad by the department of public utilities, division of water.

HAMILTON, O.—The county commissioners will spend $18,000 for a 18 x 240-foot, concrete bridge over the Seven-mile creek at Summerville.

HAMILTON, O. — The Hooven, Owens, Rentschler Co. will double the capacity of its gray iron foundry by the addition of a 70 x 400-foot bay.

NEWARK, O.—The Pennsylvania railroad will build a $146,000 freight station on Fifth street in Newark. C. C. Parrill is the freight agent.

PAINESVILLE, O.—The Perfection Tube Co. has been incorporated with $100,000 capital and will take over the Foyer plant. It will manufacture automobile tubing.

TOLEDO, O.—The Scanlon Machine Co. has been incorporated with $10,000 capital by William Wilmington, Julian H. Tyler, Leland G. Gardener, E. A. Koster and E. M. Sieloff.

YOUNGSTOWN, O. — The Pressed Steel Products Co. of the Petroleum Iron Works Co. is preparing to erect a 50 x 200-foot addition to its plant.

YOUNGSTOWN, O.—The American Sintering Co. has awarded contract for the erection of a $100,000 sintering plant on Poland avenue to handle the flue dust from furnaces of the Youngstown Sheet & Tube Co., and the Republic Iron & Steel Co.

CLARKSBURG, W. VA.—E. Elford, 104 North Third street, Indianapolis, Ind., has been awarded a contract to erect a $70,000 interurban station in Clarksburg for the Monongahela Traction Co. Wilbur & Watson, architects, Leader-News building, Cleveland, prepared the plans.

INDIANA HARBOR, IND.—The O. F. Gordon Co., builder of tank cars, will construct an addition, 90 x 250 feet, to cost $40,000.

INDIANAPOLIS, IND.—The McGill Metal Co., Valparaiso, Ind., has leased a part of the plant of the Kokomo Bit Co., Kokomo, Ind. Four forging machines will be installed in the near future. The company manufactures a special alloy metal for disc shapes. Plans are being considered for removing the business from Valparaiso to Kokomo.

KOKOMO, IND.—The Oscillating Electric Fan Co. will build a factory, 80 x 144 feet, costing $22,000. E. E. Dunlap, 616 Citizens bank building, is the architect.

SOUTH BEND, IND.—The Federal Machine Co. has been incorporated with a capitalization of $50,000, to manufacture all kinds of machinery. The incorporators are Joseph C. Paxton, John W. Paxton, John Martin, Fred C. Klein and George W. Zinky.

CHICAGO.—The Gortz Brass Co. has been incorporated with $25,000 capital by Arthur W. Gortz, Fritz Gortz and William J. Bergens.

CHICAGO. — The Herschfield-Piper Foundry & Machine Co. has been incorporated with $75,000 capital by R. L. Wenstrand, Joseph Solari and J. E. Lee.

CHICAGO.—The W. A. Jones Foundry & Machine Co. will build a plant costing $200,000, including a foundry, 180 x 300 feet, a machine shop 130 x 320 feet, a 2-story pattern shop, 76 x 92 feet, an office building, two stories, 80 x 80 feet, a warehouse, 80 x 100 feet, and a power house, 40 x 80 feet, at Twelfth street and Forty-fourth avenue. Davidson & Weiss, 53 West Jackson boulevard, are the architects.

CHICAGO.—The Western Iron Construction Co., 105 South La Salle street, is taking bids on a 1-story shop 50 x 75 feet, to cost $10,000. Niels Buch, 105 South La Salle street, is architect.

GRANITE CITY, ILL.—The Hoyt Metal Co., Elliott T. Merrick president, will build an office building, 36 x 62 feet, a lead building, 85 x 168 feet and a welfare building, 85 x 87 feet, at a cost of $60,000.

JOLIET, ILL. — The Moore Bros. Co., stove manufacturer, will build a second addition, 42 x 260 feet.

NORMAL, ILL.—Bonds for $22,000 have been voted for the construction of a waterworks. T. H. Keys is the city clerk.

WOOD RIVER, ILL.—R. C. Link, architect, Carleton building, St. Louis, is preparing plans for a tannery for the International Show Co. to be erected at Wood River at a cost of $1,000,000. Information may be obtained from Ralph D. Griffen, Olive and Fifteenth streets, St. Louis.

BATTLE CREEK, MICH. — The H. B. Sherman Mfg. Co., Barney and Kalamazoo streets, will build a power plant addition to its factory.

BAY CITY, MICH.—The Zagelmyer Cast Stone Block Machine Co., 805 South Henry street, will build an office building and machine shop, 60 x 235 feet, to cost $20,000.

DETROIT. — The Continental Motor Co will build an addition, costing $100,000.

DETROIT.—The Grant Iron & Metal Co. has purchased a 6½-acre site along the Michigan Central railroad upon which it will construct a yard for handling scrap iron. A considerable amount of new machinery will be added to the present equipment to make the yard complete in every way.

DETROIT.—H. M. Lane, engineer, 707 Truss Concrete building, is preparing plans for a 1-story, 200 x 400-foot foundry to be erected for the Timken-Detroit Axle Co. Wil-

liam R. Timken, 136 Clarke avenue, is president of the company.

DETROIT. — The Michigan Metal Supply Co. has been incorporated with $5,000 capital by Ignace Capigzi, John E. Parkhurst and D. H. Creider.

FLINT, MICH.—The Dort Motor Car Co. will soon begin to erect a $60,000 factory building on land recently purchased in Flint.

HANCOCK, MICH. — The Quincy Mining Co. has awarded contracts for constructing two separate waterworks systems at the Quincy and Mesnard locations. The Chicago Birdge & Iron Co., Chicago, will furnish steel tanks for the two projects, and Herman Stensrud, Marquette, Mich., will construct eight miles of mains and service connections.

BEAVER DAM, WIS.—The Malleable Iron Range Co. is completing work on a new manufacturing unit, of brick and steel, and will now erect a new office building, 60 x 105 feet, 1-story and basement.

BROOKFIELD, WIS. — The city of Brookfield plans to construct an electric light plant and waterworks.

MARION, WIS.—Ben Goldthwaite, whose flour and feed mill was damaged by fire recently, is preparing to rebuild and will need a complete new mill equipment. The investment will be about $10,000. A. F. Ordway, Beaver Dam, Wis., is designing the mill.

MARSHALL, WIS.—The city of Marshall plans to build an electric light plant, costing $70,000. Henrici, Kent & Lawry, 716 Reserve bank building, Kansas City, are the engineers.

MILWAUKEE.—The capital stock of the Wisconsin Welding & Cutting Co., 315 Fourth street, has been increased form $3,000 to $10,000. The equipment will be enlarged.

MILWAUKEE.—The common council committee on railroads and bridges has recommended the construction of a $250,000 bascule bridge over the Milwaukee river to connect Cedar and Biddle streets.

MILWAUKEE.—Fernekes & Cramer, architects, Pabst building, are preparing plans for a $35,000 printing plant on Fifth street, for the H. G. Razall Mfg. Co., 300 Seventh avenue. It will be 70 x 150 feet, two and three stories and basement.

MILWAUKEE.—A chair factory to cost $80,000 is planned by the Milwaukee county board of supervisors for the new house of correction in North Milwaukee. Leenhouts & Guthrie, architects, are preparing the plans. A complete set of equipment will be required.

MILWAUKEE. — The Milwaukee Electric Railway & Light Co. has awarded a contract to the Bergendahl-Knight Co., Chicago, for erecting a $20,000 addition to the car barns at West Allis. The same contractor is adding a second story to the West Allis power house at a cost of $17,000.

MILWAUKEE.—A new warehoues costing $35,000 will be erected by the Kieckhefer Box Co., wood and fiber packages, at its plant at Sixteenth and Canal streets.

MILWAUKEE.—The Kroening Construction Co., 708 Majestic building, which has a general contract for constructing a $75,000 grandstand at the State Fair park, has let the structural steel contract to Hackendahl & Schmidt, Milwaukee, and the steel sash contract to the American Steel Window Co. Paul Kulman Co., St. Paul, Minn., will furnish the reinforcing material.

MILWAUKEE.—The public sewerage commission has awarded the following contracts for two units of the new $11,000,000 sewerage system: First section, Menominee low-level, intercepting sewer, the Wisconsin Tunnel & Construction Co., Milwaukee, at $268,172; second section, James Kennedy Co., Fargo, N. D., at $248,439. A considerable tonnage of cast iron pipe will be required. The contractors will furnish all material.

MILWAUKEE.—A. C. Eschweiler, architect, Goldsmith building, has closed bids for erecting the 8-story Main exchange building of the Wisconsin Telephone Co. on Broadway, between Wisconsin and Mason streets. As previously reported, it will be of brick and steel, 120 x 120 feet. The steel fabricating contract has been let to the Wisconsin Bridge & Iron Co., Milwaukee, and involves 2,600 tons. Six electric passenger elevators will be required.

MILWAUKEE.—Klug & Smith, consulting engineers, Mack block, will take bids for erecting a new drop forge plant for the John Obenberger Forge Co., at Sixty-third avenue and Lapham street, in West Allis. The company was organized recently by John Obenberger, with a capital of $200,000. The main building will be of brick and steel, 80 x 150 feet, and the power house, 50 x 60 feet. Specifications call for a 100-horsepower corliss engine, two 150-horsepower boilers, a 75-kilowatt generator, three motors of 10, 20 and 40-horsepower, one 5-ton crane, a steel stack, and a complete equipment of forging presses and machine tools.

RIB LAKE, WIS.—Marshall Welch, Williamsport, Pa., has been awarded a general contract for constructing and equipping a new sawmill costing $75,000 for the Rib Lake Lumber Co. Electric power will be used throughout. The mill will be 60 x 240 feet with a separate power plant.

SHEBOYGAN, WIS.—The contract for approximately 372 tons of cast iron water pipe and fittings for the new municipal waterworks system was awarded to J. B. Clow & Sons, Chicago, at $12,419.67. Other contracts are: 32 hydrants and 29 valves, the Ludlow Valve Co., Chicago, $1,500; an 80,000-gallon steel tank on a 60-foot tower, the Chicago Bridge & Iron Co., Chicago, $4,140; a pumping station, the Keystone Drilling Co., $2,060.

SUPERIOR, WIS. — The Lake Superior Electric Co. is planning to build a factory.

TRENTON, WIS.—The city of Trenton, A. L. Taylor, clerk, will install an electric light system, including a 35 to 45-horsepower oil engine, direct-connected to a 25-kilowatt, direct current generator, and a storage battery.

WAUKESHA, WIS.—Schuchardt & Judell, architects, Milwaukee, will take bids for erecting a $50,000 factory and power house for the Waukesha Pure Food Co. The main building will be 40 x 140 feet, three stories and basement, and the power house, 40 x 40 feet. An electric elevator, fire escapes and a 30,000-gallon tank for the fire protection system are included in the plans.

KANSAS CITY.—The Phillips-Palmer Tractor Co. has been incorporated with $5,000 capital by Victor L. Phillips, A. L. Palmer Jr., and B. J. Copeland. The new company will manufacture farm tractors, farm machinery and power equipment for the farm.

ST. JOSEPH, MO. — The St. Joseph & Grand Island Railway Co., W. A. Parker, chief engineer, St. Joseph, will rebuild its bridge over the Missouri river, at a cost of $350,000.

FT. DODGE, IA.—The city of Ft. Dodge will build a dam, 350 feet long and 18 feet high, to develop 750-horsepower for operating the municipal waterworks. The project will cost $100,000.

OSSIAN, IA.—An elevated steel tank and three miles of 6 and 8-inch cast iron pipe, will be purchased for about $10,000. W. R. Coffeen, Decorah, Ia., is the engineer.

PETERSON, IA.—Bids will be received soon for a power plant for the Peterson Milling Co., to cost $15,000. J. W. Bradford, Fort Dodge, is the architect.

MINNEAPOLIS. — The Western Crucible Steel Co., 2843 Grand street, will build an addition, costing $50,000. A. F. Reitzel is secretary.

MINNEAPOLIS, MINN.—The Flour City Ornamental Iron Co. has been reorganized with $500,000 capital by Jacob Stoft, Ernest Rupert, W. J. Stevenson, J. F. Horn, E. P. Wells and A. J. Edwards.

PERHAM, MINN.—Plans for 100,000-gallon tank on a 100-foot tower are being prepared by W. C. Buck, engineer, Minneapolis.

ST. PAUL, MINN.—John H. Willys, Toledo, head of the Willys-Overland Co., announces that the company will invest $2,000,000 in the erection and equipment of a distributing plant at St. Paul.

In the South and Around the Gulf

ROANOKE, VA.—Ballinger & Perrot, Philadelphia, have invited bids on the structural contract for a large plant to be erected at Roanoke for the Viscose Co. The proposed plant will consist of 5-story, 77 x 153-foot building, a 1-story and basement, 140 x 536-foot building, a 3-story, 140 x 536-foot building, a 3-story, 58 x 166-foot building, a 2-story and basement, 143 x 154-foot building, a 2-story and basement, 73 x 103-foot building and a 70 x 108-foot power house.

CHATTANOOGA, TENN.—H. D. Watts & Co., of Atlanta, Ga., have been awarded a general contract for the Volunteer State Life Insurance Co.'s new 12-story office building at Chattanooga for $330,000. Entire building to cost about $445,000. A contract for five steel elevators will be let soon by Barnwell & Barnwell, architects.

HAZARD, KY.—Conveyor equipment only remains to be purchased by the Kentucky River Power Co., which is erecting a steam-driven electric plant at Hazard. H. W. Saunders, Welch, W. Va., will purchase the conveyors.

LOUISVILLE, KY.—A contract for erecting five oil tanks, to cost upwards of $3,000, has been awarded by the Peaslee-Gaulbert Co. to the W. T. Pyne Mill Supply Co., Louisville.

LOUISVILLE, KY. — Improvements to cost $23,000 are to be made by the Liggett & Myer Tobacco Co. in its warehouse at Twenty-fourth and Main streets. Plans have been prepared by Brussell & Viterbo, architects, St. Louis.

MIDDLESBORO, KY.—Bonds for $200,000 have been sold, which makes possible the erection of a $1,000,000 cement plant at Cumberland Gap. A large quantity of machinery will be installed.

MORGANFIELD, KY.—The fiscal courts of Union and Crittenden counties will spend between $25,000 and $30,000 for a bridge over the Tradewater river.

NEW ORLEANS. — The Trans-Mississippi Bridge Co., New Orleans, has applied to the state for permission to build a bridge across the Mississippi river at New Orleans.

IRON AND STEEL PRICES

Corrected up to Tuesday noon

PIG IRON

(Lower price to Jan. 1, 1917; higher to July 1, 1917.)

Bessemer valley	$21.00 to 21.50
Bessemer, Pittsburgh	21.95 to 22.45
Basic, Pittsburgh	18.95 to 19.20
Basic, eastern Pa.	19.00 to 19.50
Basic, Buffalo	19.00 to 19.50
Malleable, Pittsburgh	19.45 to 19.95
Malleable foundry, Chicago	19.50
Malleable foundry, Philadelphia	21.50 to 21.75
Malleable foundry, Buffalo	18.50 to 19.00
No. 1X foundry, Philadelphia	20.25 to 20.75
No. 2 foundry, Pittsburgh	19.45 to 19.70
No. 2 foundry, Cleveland	18.80 to 19.30
No. 2 foundry, Ironton	18.00 to 19.00
No. 2 foundry, Chicago	19.00
No. 2X foundry, Philadelphia	19.75 to 20.25
No. 2X foundry, N. J. tidewater	20.00 to 20.50
No. 2X foundry, Buffalo	18.50 to 19.00
No. 2 plain, Philadelphia	19.25 to 19.75
No. 2 plain, N. J. tidewater	19.50 to 20.00
No. 2 plain, Buffalo	18.25 to 18.75
No. 2 southern, Birmingham	14.00 to 15.00
No. 2 southern, Cincinnati	16.90 to 17.90
No. 2 southern, Chicago	19.50 to 20.00
No. 2 southern, Phila. delivery	19.00 to 19.50
No. 2 southern, Cleveland	18.00 to 19.00
No. 2 southern, New York docks	18.00 to 18.50
No. 2 southern, Boston docks	18.25 to 18.75
No. 2 south. interior, New Eng.	19.00 to 20.00
No. 2 southern, St. Louis	18.40 to 18.90
Virginia No. 2X, furnace	18.50 to 19.00
Virginia 2X, Philadelphia	21.25 to 21.75
Virginia, No. 2X, Jersey City	21.00 to 21.50
Virginia 2X, Boston points	21.75 to 22.25
Gray forge, eastern Pa.	19.00 to 19.50
Gray forge, Pittsburgh	18.95
Gray forge, Birmingham	13.00 to 14.00
Silveries, 8 per cent, furnace	25.00 to 27.00
Silveries, 8 per cent, Chicago	31.50
Low phos. Standard, Phila.	32.00 to 34.00
Low phos. Lebanon, Pa. furnace	29.00 to 31.00
Low. phos. Pittsburgh	30.00 to 31.00
Charcoal, Lake Superior, Chgo., Nos. 1 to 4	19.75 to 22.25
Charcoal, Buffalo	21.00 to 22.00
Charcoal, Birmingham	22.50 to 23.00

IRON ORE

Lake Superior Ores.
(Lower Lake Ports.)

Old range Bessemer, 55 per cent, ton	$4.45
Mesabi Bessemer, 55 per cent, ton	4.20
Old range non-Bess., 51½ per cent, ton	3.70
Mesabi non-Bess., 51½ per cent, ton	3.55

Eastern Ores.
(Per unit delivered eastern Pennsylvania.)

Pt. Henry fur., 60 per cent, unit	8.5c to 8.9c
Local N. Y. and N. J. ores, unit	8.5c to 8.75c
Port Henry lump, at mines, ton	$4.00

Foreign Ores.
(Per unit Philadelphia.)
(Prices nominal.)

Foreign Bess., 50 to 65 per cent	8 to 8½
For'n non-Bess., 50 to 65 per cent	8 to 8½

COKE

(At the ovens.)

Connellsville furnace	$2.35 to 2.50
Connellsville fur., contract	2.65 to 2.75
Connellsville foundry, contract	3.50 to 3.75
Connellsville foundry	3.00 to 3.50
Wise county furnace, contract	2.85 to 3.25
Wise county foundry, contract	3.50 to 3.75
Pocahontas foundry, contract	3.25 to 3.75
Pocahontas furnace, contract	2.85 to 3.25
New River foundry, contract	3.75 to 4.25
New River furnace, contract	3.25 to 3.50

FERRO ALLOYS AND STEEL MAKING METALS

Ferro manganese, 80 per cent, seaboard, prompt	$225 to 275
Ferro manganese, 80 per cent, seaboard, contract	175
Spiegel, 20 per cent, fur. early and last half	50.00 to 55.00
Ferro-silicon, 50 per cent, Phil.	83.00 to 85.00
Ferro-silicon, 50 per cent, Pbgh.	83.00 to 85.00

Bessemer ferro-silicon, 9 per cent to 10 per cent, $32.00; 10 to 11 per cent, $33.00; 11 to 12 per cent, $34.00; 12 to 13 per cent, $35.00 a ton at the furnace at Ashland, Jackson and New Straitsville, O.

Ferro-carbon titanium, 8 to 12½ cents per pound in carloads.

SEMI-FINISHED MATERIAL

Open hearth billet, Phila.	$45.00 to 50.00
Forging billets, Phila.	65.00 to 70.00
Forging billets, Pbgh., nominal	65.00 to 70.00
Forging billets, Chicago	65.00
Wire rods, Pittsburgh (nom.)	60.00 to 65.00
Bessemer billets, Youngstown	39.00 to 42.00
Bessemer billets, Pittsburgh	40.00 to 45.00
Open hearth billets, Pittsburgh	40.00 to 45.00
Open hearth billets, Youngstown	39.00 to 42.00
Bess. sheet bars, Youngstown	39.00 to 42.00
Op. h'th sheet bars, Youngstown	39.00 to 42.00
Bess. sheet bars, Pittsburgh	40.00 to 45.00
Open hearth sheet bars, Pbgh.	40.00 to 45.00
Muck bar, Pittsburgh (nominal)	40.00 to 45.00

SKELP

Grooved steel skelp	2.50c
Sheard steel skelp	2.75c

RAILS AND TRACK MATERIAL

(Gross tons.)

Stand. Bess. rails, Pbgh. & Chg. delivery after May 1, 1917	$33.00
Stan. op-h'th rails, Pbgh. & Chg. delivery after May 1, 1917	35.00
Light rails, 8 to 10 lbs., Pbgh.	50.00
Light rails, 8 lb., Chicago	43.00
Light rails, 12 to 14 lbs., Pbgh.	49.00
Light rails, 12 lbs., Chicago	42.00
Light rails, 16 to 20 lbs., Pbgh.	48.00

Freight Rates, Pig Iron

Mahoning and Shenango valleys to:—	
Cleveland	$0.95
Newark, N. J.	2.98
Boston	3.18
Philadelphia	2.78
Pittsburgh	.95
St. Louis	3.18
Buffalo to:—	
Albany, N. Y.	$1.26
New England (all rail)	2.58
New York and Brooklyn (all rail)	2.58
New York and Brooklyn (by canal)	1.25 to 1.60
Virginia furnaces to:—	
Boston docks (r. ad w.)	$3.05
New England (all rail)	3.25
New York dock (r. and w.)	2.88
Birmingham, Ala., to:—	
Cincinnati	$2.90
Chicago	4.00
Cleveland	4.00
Louisville, Ky.	2.65
New York (all rail)	6.15
New York, (r. and w.)	4.25
Philadelphia (all rail)	5.20
Philadelphia (r. and w.)	4.00
Pittsburgh	4.90
Savannah, Ga.	2.75
Chicago to:—	
Des Moines	$2.80
Milwaukee	.50
Moline, Ill.	1.40
Omaha	3.58
St. Louis	1.58
Ironton and Jackson, O., to:—	
Chicago	$2.54
Cincinnati	1.26
Cleveland	1.62
Detroit	1.81
Indianapolis	1.58

Light rails, 16 to 20 lbs., Chgo.	$41.00
Light rails, 25 to 45 lbs., Pbgh.	47.00
Light rails, 25 to 45 lbs., Chgo.	40.00
Relaying rails, standard, Pbgh. and Chicago	$23.00 to 24.00
Relaying rails, light, Chicago	24.00 to 25.00
Angle bars, st. sect., Pbgh. base	2.00c
Angle bars, st. sections, Chgo.	2.00c to 2.50c
Spikes, railroad, Pittsburgh	2.65c to 2.75c
Spikes, railroad, Chicago	2.75c to 2.90c
Track bolts, Pittsburgh	3.25c to 3.50c
Track bolts, Chicago	3.25c to 3.50c
Tie plates, Chicago	50.00 to 55.00

SHAPES, PLATES AND BARS

Structural shapes, Pbgh.	2.50c to 2.75c
Structural shapes, Philadelphia	2.659c to 3.159c
Structural shapes, Chgo.	2.69c to 3.29c
Structural shapes, New York	2.669c to 3.169c
Tank plates, Chgo.	3.09c to 3.49c
Tank plates, Pittsburgh (con.)	2.75c to 2.90c
Tank plates, Pittsburgh	3.00c to 4.25c
Tank plates, Philadelphia	2.909c to 3.909c
Tank plates, New York	2.919c to 3.919c
Bars, soft steel, Chicago	2.69c to 3.29c
Bars, soft steel, Pbgh.	2.50c to 2.75c
Bars, soft steel, New York	2.669c to 2.916c
Bars, soft steel, Philadelphia	2.659c to 2.905c
Hoops, carloads, Pittsburgh	2.75c to 3.00c
Bands, Pittsburgh	2.50c to 2.75c
Shafting, Pbgh., contr. carloads	10 to 20 off
Bar iron, Chgo.	2.35c to 2.50c
Bar iron, Philadelphia	2.559c
Bar iron, Cleveland	2.40c
Bar iron, New York	2.569c
Bar iron, Pittsburgh	2.65c to 2.75c
Hard steel bars, Chgo.	2.50c to 2.75c

SHEETS AND TIN PLATE

Bessemer.

BLUE ANNEALED SHEETS PITTSBURGH

	Per lb.
Nos. 3 to 8	2.95c to 3.20c
Nos. 9 to 10	3.10c to 3.35c
Nos. 11 and 12	3.15c to 3.40c
Nos. 13 and 14	3.20c to 3.45c
Nos. 15 and 16	3.30c to 3.55c

Bessemer.

BOX ANNEALED SHEETS, COLD ROLLED PITTSBURGH

Nos. 17 to 21	2.70c to 2.85c
Nos. 22 and 24	2.75c to 2.90c
Nos. 25 and 26	2.80c to 2.95c
No. 27	2.85c to 3.00c
No. 28	2.90c to 3.05c
No. 29	2.95c to 3.10c
No. 30	3.05c to 3.30c

Bessemer.

GALVANIZED SHEETS OF BLACK SHEET GAGE, PITTSBURGH

Nos. 10 and 11	3.60c to 3.95c
No. 12	3.70c to 4.05c
Nos. 13 and 14	3.70c to 4.05c
Nos. 15 and 16	3.80c to 4.15c
Nos. 17 to 21	3.95c to 4.30c
Nos. 22 and 24	4.15c to 4.50c
Nos. 25 and 26	4.30c to 4.65c
No. 27	4.45c to 4.75c
No. 28	4.60c to 4.95c
No. 29	4.75c to 5.10c

No. 28, black, Chicago	3.09c to 3.19c
No. 28, galvanized, Chicago	5.19c
No. 10, blue annealed, Phila.	3.409c to 3.909c
No. 10, blue annealed, Chgo.	3.24c to 3.44c
Tin plate, 100 lb., coke base	$5.75 to 6.00

IRON AND STEEL PIPE

(Prices Adopted April 21, 1916.)

Steel.

Butt weld:—	Black.	Galv.
⅛, ¼ and ⅜ in.	63	30
½ in.	67	40
¾ to 3 in.	70	50
Lap weld:—		
2 in.	65	40
2½ to 6 in.	68	48
7 to 12 in.	65	44½
13 and 14 in.	53½	..
15 in.	51	..

Iron.

Butt weld:—	Black.	Galv.
⅛ and ¼ in.	52	19
⅜ in.	53	20
½ in.	57	33
¾ to 1¼ in.	60	38
Lap weld:—		
1¼ in.	48	26
1½ in.	54	33
2 in.	55	34
2½ to 4 in.	57	37
4½ to 6 in.	57	37
7 to 12 in.	56	36

BOILER TUBES

Steel, 3½ to 4½ inches, l. c. l.	50 to 52
Iron, 3½ to 4½ inches, l. c. l.	40 to 42

WIRE PRODUCTS

(Retailers' price 5 cents above jobbers' quotations.)

Wire nails, jobbers', Pittsburgh	$2.50 to 2.70
Plain wire, jobbers', Pittsburgh	2.45
Galvanized wire, jobbers', Pbgh.	3.15
Polished staples, Pbgh.	2.65
Galvanized staples, Pbgh.	3.35
Barb wire, painted, jobbers', Pbgh.	2.65
Barb wire, galv., jobbers', Pbgh.	3.35

IRON AND STEEL PRICES

Corrected up to Tuesday noon

BOLTS AND NUTS

(Delivered within 20-cent freight radius.)

Carriage bolts, ⅜ x 6 inches, smaller or shorter, rolled thread, 50 and 10, cut threads, 50, larger or longer, 40.

Machine bolts with hot pressed nuts, ⅜ x 4 inches, smaller or short, rolled 50, 10 and 5; cut, 50 and 5; larger or longer, 40 and 10.

Cold pressed, semi-finished hexagon nuts, 60 and 10.

Gimlet and cone point lag bolts, 50 and 10. Hot pressed square, blank or tapped nuts, $2.90 off list; hot pressed hexagon blank or tapped, $2.90.

Cold pressed square, blank or tapped, $2.60 off; hexagon, blank or tapped, all sizes, $3.00.

RIVETS

Structural rivets, Pbgh	4.25c
Structural rivets, Chgo. delivery	3.50c
Boiler rivets, Pbgh	4.35c
Boiler rivets, Chgo. delivery	3.60c

STEEL SHEET PILING

(Pittsburgh)

Base sizes	2.50c

STANDARD STEEL CHAIN

Chain, ⅜ inch proof coil	5.00c to 5.50c

COLD ROLLED STRIP STEEL

Base price 6.00c to 6.50c per 100 pounds, hard, coils 1½ inches and wider and by .100 inches and heavier.

Extra for Thickness.

0.100-inch and thicker	Base
0.050 to 0.099	$0.05
0.036 to 0.049	0.20
0.035	0.20
0.031 to 0.034	0.35
0.026 to 0.030	0.45
0.020 to 0.024	0.55
0.025	0.45
0.017 to 0.019	1.35
0.015 to 0.016	1.75
0.013 to 0.014	2.45
0.012	2.80
0.011	3.15
0.010	3.50

Other extras as per card of March 15, 1916.

CAST IRON WATER PIPE

Four-inch, Chicago	$33.50 to 34.00
Six-inch and larger, Chicago	30.50 to 31.00
Six-inch Class B, New York	30.50
Four-inch Class B New York	33.50
Four to six-inch Birmingham	28.00
Six-inch and larger Birmingham	25.00

Light weight water and gas pipe $1 per ton higher than standard water.

WAREHOUSE PRICES

Steel bars, Chicago	3.10c
Steel squares, 2-in. & ov., Cleve.	3.75c
Steel rounds, 2-in. & ov., Cleve.	3.75c
Steel bars, under 2 in., Cleveland	3.25c
Steel bars, Detroit	3.25c
Steel bars, Philadelphia	3.25c to 4.10c
Steel bars, New York	3.25c to 3.50c
Steel bars, St. Louis	3.15c
Steel bars, Cincinnati	3.20c to 3.75c
Steel bars, St. Paul	3.20c
Steel bars, over 2-in., Buffalo	4.20c
Steel bars, Buffalo	3.35c
Iron bars, Chicago	3.10c
Iron bars, Cleveland	3.20c
Iron bars, Detroit	3.25c
Iron bars, St. Louis	3.10c
Iron bars, Cincinnati	3.20c to 3.75c
Iron bars, Philadelphia	3.00c to 3.25c
Iron bars, New York	3.25c
Shapes, Chgo.	3.10c
Shapes, Detroit	3.25c
Shapes, St. Louis	3.15c
Shapes, St. Paul	3.20c
Shapes, New York	3.25c to 3.50c
Shapes, Cleveland	3.25c
Shapes, Philadelphia	3.00c to 3.25c
Shapes, Buffalo	3.35c
Shapes and plates, Cincinnati	3.20c to 3.50c
Plates, Chgo.	3.50c
Plates, Detroit	3.60c to 4.00c
Plates, St. Louis	3.55c
Plates, St. Paul	3.60c
Plates, New York	4.25c to 4.50c
Plates, Cleveland	3.65c
Plates, Philadelphia	4.00c to 4.25c
No. 10 blue anl. sheets, Chgo.	3.40c
No. 10 blue anl. sheets, Cleve.	3.50c
No. 10 blue anl. sheets, Buffalo	3.25c
No. 10 blue anl. sheets, St. L.	3.45c
No. 10 blue anl. sheets, Cinci.	3.50c
No. 10 blue anl. sheets, St. Paul	3.50c
No. 10 blue anl. sheets, Detroit	3.55c
No. 28 black sheets, Chgo.	3.20c
No. 28 black sheets, Cleveland	3.20c to 3.25c
No. 28 black sheets, Cinci.	3.40c
No. 28 black sheets, Detroit	3.50c
No. 28 black sheets, St. Louis	3.30c
No. 28 black sheets, St. Paul	3.35c
No. 28 galv. sheets, Chgo.	5.25c to 5.50c
No. 28 galv. sheets, Cleveland	5.25c
No. 28 galv. sheets, Cincinnati	5.25c
No. 28 galv. sheets, Detroit	5.25c
No. 28 galv. sheets, St. Louis	5.30c to 5.50c

Freight Rates, Coke

Connellsville district, per 2,000 lbs., to:—	
Baltimore	$1.80
Buffalo	1.85
Chicago	2.50
Cleveland	1.60
Detroit	2.10
East St. Louis	2.80
Joliet	2.50
Louisville	2.50
Milwaukee	2.85
New York	2.85
Philadelphia	2.05
Pittsburgh	.75
Richmond, Va.	2.94
Toledo	1.85
Valley Furnaces	1.20
Cincinnati	2.00

IRON AND STEEL SCRAP

(Net Tons.)

Angle bars, iron, Chicago	$18.00 to 18.50
Angle bars, steel, St. Louis	12.50 to 13.00
Arch bars and transoms, Chgo.	19.50 to 20.00
Arch bars and transoms, St. L.	19.00 to 20.00
Boiler plate, cut, No. 1, Chgo.	10.50 to 11.00
Boiler plate, cut, No. 1, St. L.	8.50 to 9.00
Boiler punchings, Chicago	14.00 to 14.50
Bundled sheet, Cincinnati	8.25 to 8.75
Busheling, No. 1, Chicago	12.00 to 12.50
Busheling, No. 1, Cincinnati	10.00 to 10.50
Busheling, No. 1, Cleveland	12.00 to 12.75
Busheling, No. 1, St. Louis	10.00 to 10.50
Busheling, No. 2, Chicago	8.75 to 9.25
Cast borings, Chicago	6.00 to 6.50
Cast borings, Cincinnati	5.50 to 6.00
Cast borings, Cleveland	5.75 to 6.00
Cast borings, St. Louis	5.25 to 5.75
Cast, No. 1, Chicago	12.00 to 12.50
Cast, No. 1, Cincinnati	10.50 to 11.00
Cast, No. 1, Cleveland	13.00 to 13.50
Cast, No. 1, St. Louis	9.75 to 10.25

Freight Rates, Finished Material

From Pittsburgh, carloads, per 100 lbs. to:—

New York	16.9 cents
Philadelphia	15.9 cents
Boston	18.9 cents
Buffalo	11.6 cents
Baltimore	15.4 cents
Cleveland	10.5 cents
Cincinnati	15.8 cents
Chicago	18.9 cents
Minneapolis and St. Paul	32.9 cents
Denver	68.6 cents
St. Louis	23.6 cents
New Orleans	30 cents
Birmingham	45 cents
Pacific coast (all rail)	73.9 cents
Pacific coast (tin plate)	70 cents
Pacific coast, via Panama canal	61.9 cents

Cut forge, Chicago	13.75 to 14.25
Iron axles, St. Louis	21.50 to 22.00
Iron axles, Cleve.	23.00 to 24.00
Knuckles, coup., Chicago	15.50 to 16.00
Knuckles, coup., St. Louis	12.75 to 13.25
Locomotive tires, Chicago	20.00 to 20.50
Locomotive tires, St. Louis	19.50 to 20.00
Machine shop turnings, Chgo.	5.50 to 6.00
Machine shop turnings, Cleve.	6.00 to 6.25
Machine shop turnings, Cinci.	5.50 to 6.00
Machine shop turnings, St. L.	5.25 to 5.75
Malleable agricultural, Chgo.	11.00 to 11.50
Malleable agricultural, St. Louis	10.00 to 10.50
Malleable, Cincinnati	8.25 to 8.75
Malleable railroad, Chicago	12.00 to 12.50
Malleable railroad, St. Louis	11.00 to 11.50
Pipes and flues, Cleveland	11.25 to 11.50
Pipes and flues, Chgo.	10.75 to 11.25
Pipes and flues, St. Louis	9.00 to 9.50
Railroad wrought, No. 1, Chgo.	15.00 to 15.50
Railroad wrought, No. 1, Cleve.	15.00
Railroad wrought, No. 1, St. L.	14.50 to 15.00
Railroad wrought, No. 1, Cinci.	13.00 to 13.50
Railroad wrought, No. 2, Chgo.	14.00 to 14.50
Railroad wrought, No. 2, St. L.	13.50 to 14.00
Shafting, St. Louis	$16.75 to 17.25
Springs, St. Louis	12.75 to 13.25
Springs, Chicago	16.00 to 16.50
Steel car axles, St. Louis	23.00 to 23.50
Steel car axles, Chicago	25.00 to 25.50
Stove plate, Chicago	11.25 to 11.75
Stove plate, Cleveland	10.00
Stove plate, Buffalo	11.00 to 11.50
Stove plate, Cincinnati	8.00 to 8.50
Stove plate, St. Louis	7.00 to 7.50

(Gross tons.)

Axle turnings, Cleve.	$11.50 to 12.00
Busheling, No. 1, Buffalo	13.00 to 13.50
Busheling, No. 1, Pittsburgh	13.00 to 13.50
Busheling, No. 2, Buffalo	11.00 to 11.50
Bundled sheets, Pittsburgh	12.50 to 12.75
Bundled sheets, Cleveland	12.50 to 12.75
Bundled sheets, Buffalo	11.50 to 12.00
Car wheels (iron), Pittsburgh	14.00 to 14.50
Car wheels (steel), Pittsburgh	17.50 to 18.00
Car wheels, Chicago	12.50 to 13.00
Car wheels, eastern Pa.	16.00 to 16.50
Car wheels, Buffalo	13.50 to 14.00
Car wheels, N. Y.	13.75 to 14.00
Car wheels, St. Louis	11.50 to 12.00
Car wheels, Birmingham	10.50 to 11.00
Tram car wheels, B'ham.	10.50 to 11.00
Cast borings, New York	7.50 to 8.00
Cast borings, eastern Pa.	10.00 to 10.50
Cast borings, Buffalo	8.00 to 8.25
Cast borings, Pittsburgh	8.75 to 9.00
Cast, No. 1, eastern Pa.	16.00 to 16.50
Cast, No. 1, Pittsburgh	15.00 to 15.50
Cast, No. 1, Birmingham	11.00 to 11.50
Cast, heavy No. 1, N. J. points	16.00 to 16.50
Forge, No. 1, eastern Pa.	13.00 to 13.50
Frogs, switches, guards, St. L.	14.00 to 14.25
Grate bars, Buffalo	11.50 to 12.00
Grate bars, N. J. points	13.00 to 13.50
Heavy axle turnings, Buffalo	12.00
Heavy melting steel, Pbgh	16.00 to 16.25
Heavy melting steel, Buffalo	15.50 to 16.00
Heavy melting steel, Chgo.	14.50 to 15.00
Heavy melting steel, Cleveland	15.00 to 15.25
Heavy melting steel, Cincinnati	13.50 to 14.00
Heavy melting steel, eastern Pa.	14.75 to 15.25
Heavy melting steel, New York	13.25 to 13.50
Heavy melting steel, St. L.	14.25 to 14.75
Heavy melting steel, B'ham.	9.50 to 10.00
Iron rails, Chgo.	18.00 to 18.50
Iron rails, Buffalo	18.00 to 18.50
Iron rails, Cincinnati	13.50 to 14.00
Iron rails, St. Louis	16.00 to 16.50
Iron rails, Cleveland	18.00
Iron axles, Pittsburgh	25.50 to 26.00
Iron axles, Cincinnati	20.00 to 20.50
Iron axles, eastern Pa.	27.00 to 28.00
Iron axles, Chicago	25.75 to 26.75
Iron axles, Buffalo	24.00 to 24.50
Low phos. steel, Buffalo	20.00 to 20.50
Low phos. steel, Pbgh	19.50 to 20.50
Low phos. steel, eastern Pa.	21.00 to 22.00
Machine, shop turnings, Buffalo	7.00 to 7.50
Mch. shop turnings, New York	7.00 to 7.50
Mch. shop turnings, Pbgh	8.25 to 9.00
Mch. shop turnings, eastern Pa.	8.50 to 9.00
Malleable railroad, Cleveland	14.50 to 15.00
Malleable railroad, Buffalo	15.00 to 16.00
Malleable railroad, Pittsburgh	14.00 to 14.50
Malleable railroad, eastern Pa.	13.00 to 13.50
R. R. and mch. cast, No. 1 Bfl.	15.50 to 16.00
R. R. wrought, No. 1, Buffalo	17.25 to 17.75
R. R. wrgt., No. 1, eastern Pa.	19.50 to 20.00
R. R. wrgt., No. 1, New York	18.00 to 18.50
R. R. wrought, No. 1, Pbgh.	18.00 to 18.50
R. R. wrought No. 1, B'ham.	13.00 to 13.50
Reroll. rails, 5 ft. & ov., Pbgh.	16.75 to 17.25
Reroll. rails, 5 ft. & ov., Chgo.	15.75 to 16.25
Reroll. rails, 5 ft. & ov., Cleve.	15.00
Reroll. rails, 5 ft. & ov., E. Pa.	17.00 to 18.00
Reroll. rails, 5 ft. & ov., St. L.	15.25 to 15.75
Shafting, New York	20.00 to 20.50
Shafting, eastern Pa.	20.00 to 21.00
Shoveling steel, Chicago	13.50 to 14.00
Shoveling steel, St. Louis	11.50 to 12.00
Steel rails, short, Chicago	15.50 to 16.00
Steel rails, short, Cleveland	18.50
Steel rails, old, B'ham.	11.00 to 11.25
Steel rails, short, St. Louis	14.00 to 14.50
Steel car axles, Birmingham	21.00 to 22.00
Steel car axles, New York	25.00 to 25.50
Steel car axles, Buffalo	24.00 to 24.50
Steel car axles, Cleveland	28.00
Steel car axles, Pittsburgh	26.50 to 27.00
Steel car axles, eastern Pa.	25.00 to 26.00
Stove plate, N. J. points	12.25 to 12.75
Stove plate, Birmingham	10.00 to 10.50
Stove plate, Pittsburgh	10.50 to 10.75
Stove plate, eastern Pa.	12.25 to 12.75
Wrought pipe, New York	10.25 to 10.75
Wrought pipe, eastern Pa.	12.50 to 13.00
Wrought pipe, Buffalo	12.00 to 12.50

"Where-To-Buy"

A classified-by-products list of advertisers for the convenience of readers. If you don't find what you want, write us and we will tell you where to get it. ¶ Index to advertisements will give you page number of any advertiser and by referring to advertisement you can get full particulars about products.

ACETYLENE IN CYLINDERS.
Linde Air Products Co., New York City.
Prest-O-Lite Co., The, Indianapolis, Ind.

ACCUMULATORS.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Tod, Wm., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Watson-Stillman Co., New York City.
Wood, R. D., & Co., Philadelphia, Pa.

ACCUMULATORS.
(Hydraulic.)
Southwark Fdy & Mch. Co., Philadelphia, Pa.

AEROPLANE WIRE, STRAND AND CORD.
Roebling's, John A., Sons Co., Trenton, N. J.

ALLOYS.
American Vanadium Co., Pittsburgh, Pa.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Blackwell, Geo. G., Sons & Co., Ltd., Liverpool, Eng
Bourne-Fuller Co., The, Cleveland, O.
Carnegie Steel Co., Pittsburgh, Pa.
Central Steel Co., The, Massillon, O.
Edgertyn & Company, Inc., New York City.
Titanium Alloy Mfg. Co., Niagara Falls, N. Y.
United Steel Co., Canton, O.

ALUMINUM ALLOYS.
United Smelt'g & Alum. Co., New Haven, Ct.

ALUMINUM.
(Granulated.)
United Smelt'g & Alum. Co., New Haven, Ct.

ALUMINUM.
(Solder.)
United Smelt'g & Alum. Co., New Haven, Ct.

ALUMINUM.
(Vanadium.)
American Vanadium Co., Pittsburgh, Pa.

ALUMINUM INGOTS.
United Smelt'g & Alum. Co., New Haven, Ct.

ALUMINUM RODS.
(Sheet.)
United Smelt'g & Alum. Co., New Haven, Ct.

ANGLES, TEES, CHANNELS.
(See Steel, Structural.)

ANNEALING BOXES AND POTS.
Mesta Machine Co., Pittsburgh, Pa.
Pittsburgh Annealing Box Co., Pittsburgh, Pa.
Pittsburgh Malleable Iron Co., Pittsburgh, Pa.
Pittsburgh Valve Foundry & Const. Co., Pittsburgh, Pa.
Swedish Crucible Steel Co., Detroit, Mich.
United Engrg. & Foundry Co., Pittsburgh, Pa.
Zanesville Malleable Iron Co., Zanesville, O.

ARMATURES.
Crocker-Wheeler Co., Ampere, N. J.
General Electric Co., Schenectady, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

ASH BUCKETS.
Lakewood Engrg. Co., Cleveland, O.

AXLES.
American Bridge Co., New York City.
Bethlehem Steel Co., So. Bethlehem, Pa.
Cambria Steel Co., Philadelphia, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Illinois Steel Co., Chicago, Ill.
Lockhart Iron & Steel Co., Pittsburgh, Pa.
National Tube Co., Pittsburgh, Pa.
Otis Steel Co., Cleveland, O.

BABBITT METAL.
Lubricating Metal Co., The, New York City.

BAKERS, WIRE COATING.
Morgan Construction Co., Worcester, Mass.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

BALLS.
(Steel.)
Bethlehem Steel Co., The, So. Bethlehem, Pa.
New Departure Mfg. Co., Bristol, Conn.

BANDS.
(Steel.)
Carnegie Steel Co., Pittsburgh, Pa.

BARGES.
(Steel.)
American Bridge Co., New York City.

BARRELS, TUMBLING.
(Wire Nails.)
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

BARS—ALLOY.
Central Steel Co., The, Massillon, O.

BARS.
(Concrete Reinforcing.)
Bourne-Fuller Co., Cleveland, O.
Cambria Steel Co., Philadelphia, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Cincinnati Iron & Steel Co., Cincinnati, O.
Franklin Steel Works, Franklin, Pa.
Inland Steel Co., Chicago, Ill.
Laclede Steel Co., St. Louis, Mo.
Ryerson, Jos. T., & Son, Chicago, Ill.
Trussed Concrete Steel Co., Detroit, Mich.
Upson Nut Co., Cleveland, O.

BARS.
(Iron and Steel.)
American Bridge Co., New York, N. Y.
American Iron & Steel Mfg. Co., Lebanon, Pa.
Belmont Iron Works, Philadelphia, Pa.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Bourne-Fuller Co., Cleveland, O.
Brown-Wales Co., Boston, Mass.
Carnegie Steel Co., Pittsburgh, Pa.
Cincinnati Iron & Steel Co., Cincinnati, O.
Franklin Steel Works, Franklin, Pa.
Harvey, Arthur C., Co., Boston, Mass.
Illinois Steel Co., Chicago, Ill.
Illinois Steel Co., Warehouse Dept., Chicago, Ill
Illinois Steel Warehouse Co., St. Louis, Mo.
Illinois Steel Warehouse Co., St. Paul, Minn.
Inland Steel Co., Chicago, Ill.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Lackawanna Steel Co., Buffalo, N. Y.
Lockhart Iron & Steel Co., Pittsburgh, Pa.
Milton Mfg. Co., Milton, Pa.
Republic Iron & Steel Co., Youngstown, O.
Ryerson, Joseph T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.
Standard Gauge Steel Co., Beaver Falls, Pa.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.
Trussed Concrete Steel Co., Detroit, Mich.
United Steel Co., Canton, O.
Upson Nut Co., Cleveland, O.

BEAMS, CHANNELS AND ANGLES.
Belmont Iron Works, Philadelphia, Pa.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Bourne-Fuller Co., Cleveland, O.
Cambria Steel Co., Philadelphia, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Franklin Steel Works, Franklin, Pa.
Illinois Steel Co., Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.

BEARINGS.
(Ball.)
New Departure Mfg. Co., Bristol, Conn.

BEARINGS.
(Vanadium Steel.)
American Vanadium Co., The, Pittsburgh, Pa.

BELLS.
(Marine and Locomotive.)
Vanduzen, E. W., Co., The, Cincinnati, O.

BELT CEMENT AND DRESSING.
Dixon, Jos., Crucible Co., Jersey City, N. J.
Graton & Knight Mfg. Co., Worcester, Mass.
Texas Company, The, New York City.
Williams, I. B., & Sons, Dover, N. H.

BELT LACING.
(Leather.)
Chicago Rawhide Mfg. Co., Chicago, Ill.
Graton & Knight Mfg. Co., Worcester, Mass.
Williams, I. B., & Sons, Dover, N. H.

BELTING.
(Chain.)
Link-Belt Co., Chicago, Ill.

BELTING—LEATHER.
Chicago Rawhide Mfg. Co., Chicago, Ill.
Graton & Knight Mfg. Co., Worcester, Mass.
Williams, I. B., & Sons, Dover, N. H.

BENCHES.
(Steel.)
New Britain Mach. Co., New Britain, Conn.

BENCHES AND FRAMES.
(Drawing.)
Morgan Construction Co., Worcester, Mass.
Turner, Vaughn & Taylor Co., The, Cuyahoga Falls, O.

BENDING AND STRAIGHTENING MACHINES.
Abramsen Engrg. Co., Pittsburgh, Pa.
Bertsch & Co., Cambridge City, Ind.
Birdsboro St'l Fdy. & Mch. Co., Birdsboro, Pa.
Cleveland Punch & Shear Works Co., Cleveland, O.
Covington Machine Co., Covington, Va.
Espen-Lucas Machine Works, Philadelphia, Pa.
Hinman, D. A., & Co., Sandwich, Ill.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Niles-Bement-Pond Co., New York, N. Y.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Watson-Stillman Co., New York, N. Y.

BENZOL RECOVERY PLANTS.
Koppers, H., Co., Pittsburgh, Pa.

BILLETS.
Andrews Steel Co., The, Newport, Ky.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Bourne-Fuller Co., Cleveland, O.
Cambria Steel Co., Philadelphia, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Central Steel Co., The, Massillon, O.
Illinois Steel Co., Chicago, Ill.
Inland Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
Lackawanna Steel Co., Buffalo, N. Y.
Otis Steel Co., Cleveland, O.
Republic Iron & Steel Co., Youngstown, O.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.
Upson Nut Co., Cleveland, O.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Wood, Alan, Iron & Steel Co., Philadelphia.
Youngstown Sheet & Tube Co., Youngstown.

BLAST FURNACE SKIP CARS.
Lakewood Engrg. Co., Cleveland, O.

BLAST FURNACE VOLUME METERS.
Clark, Chas. J., Chicago, Ill.

BLOCKS.
Bethlehem Steel Co., The, So. Bethlehem, Pa.

BLOOMS.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Bourne-Fuller Co., Cleveland, O.
Cambria Steel Co., Philadelphia, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Hillman, J. H., & Sons, Pittsburgh, Pa.
Illinois Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
Lackawanna Steel Co., Buffalo, N. Y.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.
Upson Nut Co., Cleveland, O.
Wood, Alan, Iron & Steel Co., Philadelphia.
Youngstown Sh't & Tube Co., Youngstown, O.

See Index to Advertisements for Pages Containing Advertisements of Companies Listed Above

OVER 3800 STOKERS IN 3 YEARS!!

SOLD FROM OUR OFFICE

TO THE LARGEST PLANTS AND FACTORIES IN AMERICA.

TYPE "E." The underfeed stoker without a rival for simplicity, general efficiencies and durability. Our patrons will be pleased to corroborate this.

TYPE "H." The stoker for metallurgical purposes that has no competitor.

COXE TRAVELING GRATE. In successful operation over 20 years and now specially designed and adapted for burning—**COKE BREEZE.**

May we send you our Bulletins. *Bell 2322 Court.*

GEORGE J. HAGAN CO., 401 Peoples Bank Building, Pittsburgh, Pa.

BLUE CHIP

AND OTHER

FIRTH-STERLING TOOL STEELS

The knowledge, experience and skill of Sheffield combined with the best Pittsburgh practice have made these steels the Standards of Quality and Uniformity wherever Tools are used.

FIRTH-STERLING STEEL COMPANY

McKeesport, Pa.

Boston New York Philadelphia Chicago Detroit Cleveland Pittsburgh San Francisco

JOHN O. PEW, Pres. and Gen. Mgr. MASON EVANS, Treas. H. W. HEEDY, First Vice-Pres. CHARLES B. CUSHWA, Gen. Supt. C. A. COCHRAN, Second Vice-Pres. and Sec. G. F. DANIELSON, Mgr. Pressed Steel Dept.

The Youngstown Iron & Steel Company

YOUNGSTOWN, OHIO

Manufacturers of

Red Steel Plates
Box Annealed Sheets
Blue Annealed Steel
Galvanized Steel Sheets

Bessemer and Open Hearth

Corrugated Steel Sheets---Expanded Metal and Metal Lath

Special Sheets for Deep Drawing

ALL INQUIRIES GIVEN PROMPT ATTENTION

ILLINOIS ILLINOIS

Illinois Steel Company

GENERAL OFFICES:
208 South La Salle St., Chicago, Ill.

Steel Bars for Concrete Reinforcing

Cold Twisted Squares

NEW BILLET STOCK, Open Hearth Steel, structural grade, with MINIMUM ELASTIC LIMIT of 55,000 lbs. PER SQUARE INCH. Increased physical properties allow use of less tonnage and greater variety of sizes. Only steel manufactured in the most competent and careful manner will stand the rigid physical test of cold twisting. Also the operation of cold twisting removes the adhering scales, thus permitting a better bond with the concrete.

Rounds Plain Squares Flats

NEW BILLET STOCK, either OPEN HEARTH or BESSEMER STEEL, with MINIMUM ELASTIC LIMIT of 33,000 lbs., 40,000 lbs. or 50,000 lbs. per square inch. Furnished in ANY SIZE or LENGTH and in strict accordance with MANUFACTURERS' STANDARD SPECIFICATION. Also will consider SPECIAL ANALYSIS or PHYSICAL PROPERTIES if so desired.

If you have work in hand or prospective work in view, submit details to us and let us figure with you.

BRANCH OFFICES:

Birmingham: Brown-Marx Building
Boston: John Hancock Building
Buffalo: Marine National Bank Building
Cincinnati: Union Trust Building
Cleveland: Rockefeller Building
Denver: First Nat'l Bank Building
Detroit: Ford Building
New York: Hudson Terminal Building
New Orleans: Maison Blanche
Philadelphia: Widener Building
Pittsburg: Carnegie Building
St. Louis: 3rd Nat'l Bank Building
St. Paul: Pioneer Building

Pacific Coast Representatives: U. S. Steel Products Co., San Francisco, Seattle, Portland, Los Angeles
Export Representatives: U. S. Steel Products Co., New York City

ILLINOIS ILLINOIS

Toncan Metal News

Vol. 1—No. 2 PUBLISHED IN THE INTEREST OF BETTER SHEET METAL June, 1916

NEW COTTON MILL DEFIES DESTRUCTION

Corrosion-Resisting and Fireproof Materials Are Used in New England Cotton Mill

Three carloads, or to be exact: 61 tons of Toncan Metal Sheets were used on the Naumkeag Steam Cotton Company's new buildings for window frames, ventilators and sawtooth skylights.

Directly in the path of the flames which swept Salem, Mass., stood this company's old buildings. They were almost totally destroyed. One costly experience of this kind was enough for this firm. And so the architects, Lockwood, Greene & Co., Boston, were instructed to make the new buildings as destruction-proof as possible.

Particular stress was laid on the window frames and skylights. These must be fireproof; otherwise flames would have easy access to the interior of the buildings when the sash was destroyed.

But they must be durable also. A replacement of 307 window frames and 53,000 square feet of skylights would be no small item. So the architects suggested Toncan Metal Corrosion-Resisting Sheets, which were eventually specified and used; E. Van Noorden & Co., Boston, doing the sheet metal work.

An Interesting Book

Do you know what causes corrosion; the difference between rust and corrosion; and why Toncan Metal is so durable? If not, write for this book. It's free.

Quoth The Corrosion Devil:

A galvanized coating covers a multitude of sins; therefore be sure that the sheet metal itself is durable.

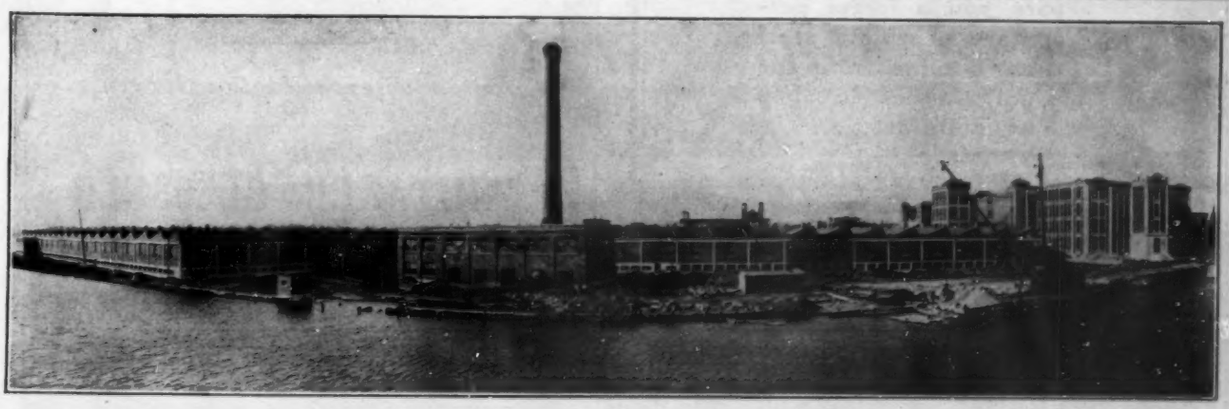
Answers to Questions

B. R. N.—No. Copper is not placed in Toncan Metal purposely. In fact, Toncan Metal contains only a trace of copper and this is the small percentage which cannot be eliminated from the ore. An excess of copper is very harmful in any iron ore product. It causes rapid corrosion.

R. F. L.—Toncan Metal is not made lighter than 28 gauge galvanized and 26 gauge black.

E. G. L.—Toncan Metal is very ductile and is excellently suited for forming and bending.

C. M. S.—Do not accept it unless it bears the Toncan Metal trade mark.



Naumkeag Steam Cotton Co., Salem, Mass. (Toncan Metal Sheets and Products Used) Lockwood, Greene & Co., Boston, Archts.

Better and Safer Roofs

are secured by using *high quality* Roofing Tin; with its positive protection from fire, lightning, storms and rain. KEYSTONE COPPER STEEL TERNE PLATES are the best obtainable—and make service a certainty.

The Copper Steel alloy base gives greatest durability—actual service tests have proved it. These plates are accurately re-squared and uniformly coated, and every detail of their manufacture is right. Our booklet, "Copper— Its Effect Upon Steel for Roofing Tin" sent upon request.

American Sheet and Tin Plate Company

GENERAL OFFICES, Frick Building, PITTSBURGH, PA.

DISTRICT SALES OFFICES:

Chicago Cincinnati Denver Detroit New Orleans New York Philadelphia Pittsburgh St. Louis

Export Representatives: UNITED STATES STEEL PRODUCTS COMPANY, New York City

Pacific Coast Representatives: UNITED STATES STEEL PRODUCTS COMPANY, San Francisco, Los Angeles, Portland, Seattle

Specify "United" Alloy Steels

Because—

Our thorough methods of manufacture and critical inspection, insure you a larger percentage of sound steel than obtains from the usual practice in alloy steel manufacture.

Specialists in Alloy Steels

THE UNITED STEEL CO CROSS ROLLED

CANTON
OHIO

Blue Annealed Sheets

Our capacity for Blue Annealed Steel Sheets is larger than ever before. All sizes 8 to 16 gauge inclusive for reasonably prompt shipments. :: :: ::

Write or wire specifications for prices

WHITAKER - GLESSNER COMPANY

Portsmouth Works:
PORTSMOUTH, OHIO

THE YOUNGSTOWN SHEET AND TUBE COMPANY

YOUNGSTOWN, OHIO

Y STEEL BRAND PIPE STAR IRON BRAND

THE YOUNGSTOWN SHEET AND TUBE COMPANY'S NEW PROCESS PATENTED YOUNGSTOWN, OHIO. GALVANIZED SHEETS

YOUNGSTOWN

The selection of **"YOUNGSTOWN"** pipe for use in the New Massachusetts Institute of Technology is testimony simple but superlative of the merits of that product.

This splendid structure, recently completed, was designed and built by engineers and architects educated in the great school that will find in it a home. They brought to their task not only the greatest skill and highest technical knowledge, but also a consecration that would consider nothing but the best for their Alma Mater. That is why they chose

"YOUNGSTOWN" PIPE

With these engineers "special" processes of manufacture, mysteries intended for the uninitiated, had no weight. They selected pipe that they knew to be the best modern product, made from the best materials and in the best manner commercially possible, and made by a concern whose reputation for ***Quality*** is as old as its mills.

These are the safe points for men who are not engineers—they show the way for the man who invests his money as well as for the man who stakes his reputation on the choice of pipe for a structure, whether large or small.

DOUBLE REFINED PUDDLED IRON ROOFING

DISTRICT SALES OFFICES

NEW YORK CITY — PHILADELPHIA, PA.
BOSTON, MASS. — CHICAGO, ILL.
PITTSBURG, PA. — DENVER, COLO.
DALLAS, TEX. — SAN FRANCISCO, CAL.
ST. LOUIS, MO. — SEATTLE, WASH.
ATLANTA, GA.

BUCKEYE FENCE

LA BELLE
TRADE MARK REGISTERED

"From Mine to Market"

The above slogan was selected because it expresses in four words the big idea behind La Belle Iron Works.

We own every ore mine, limestone quarry, gas well and coal mine from which raw materials and fuels used in the manufacture of La Belle Open Hearth Steel products are obtained.

We are independent of the open market for these things, and this fact gives us complete control of the quality of our products "from mine to market."

La Belle Iron Works
General Offices: Steubenville, O.
Works: Wheeling, W. Va.
Works: Steubenville, O.

The Lindenberg Steel Company

Manufacturers of

High Speed Carbon Tool

and

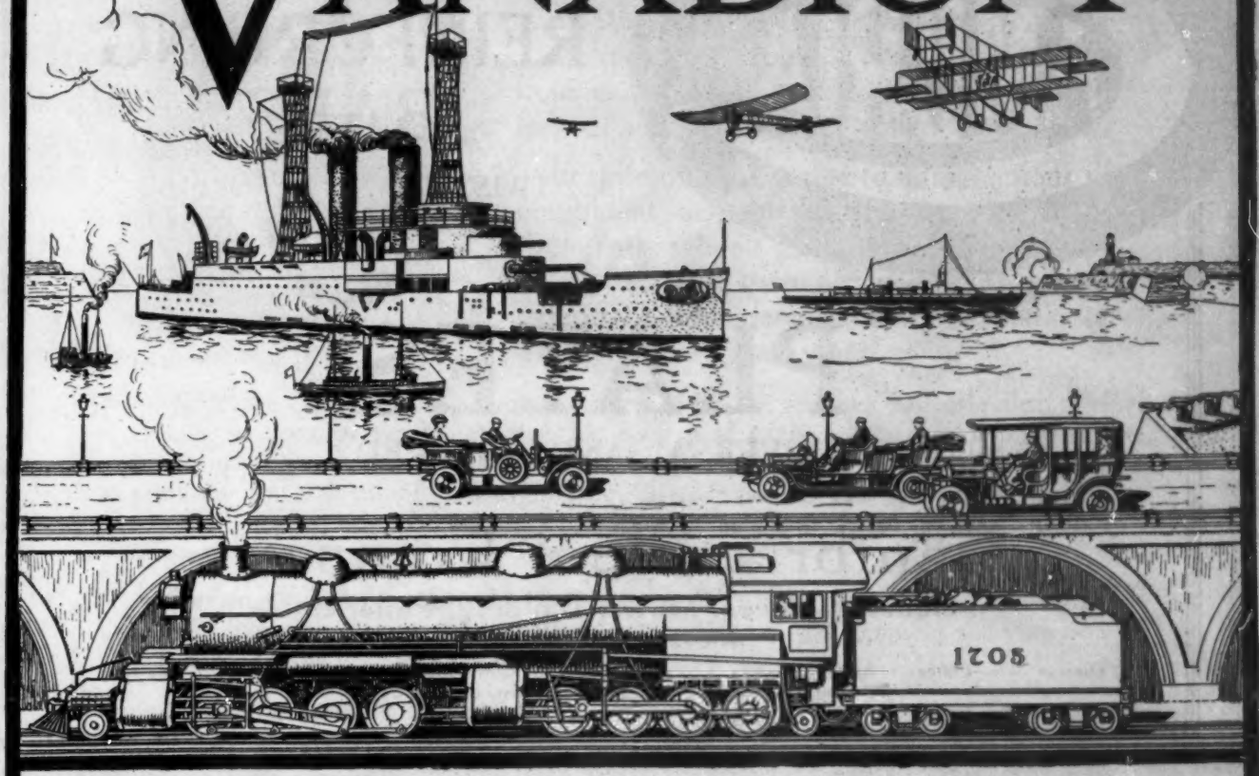
Alloy Steels

GENERAL OFFICES
90 West Street New York City
Prompt shipments from New York Stock

Red Cut Superior High Speed Steel

Quality First
THE BEST FOR MACHINING ALL HARD MATERIALS
Are your tools made of Red Cut?
Send for folder
VANADIUM-ALLOYS STEEL COMPANY
PITTSBURGH, PA.
Works at Latrobe, Pa.

VANADIUM



Where the Problem is

MAXIMUM STRENGTH

and

MINIMUM WEIGHT

The Answer is

VANADIUM STEEL

AMERICAN VANADIUM COMPANY

Pittsburgh New York London

CAMBRIA

REINFORCING BARS

TWISTED AND DEFORMED

PLATES

UNIVERSAL AND SHEARED

Cambria Steel Company

General Offices, Morris Building, Philadelphia

Works at Johnstown, Pa.

District Sales Offices: Atlanta, Boston, Chicago, Cincinnati, Cleveland, Detroit, New York, Philadelphia, Pittsburgh, Salt Lake City, San Francisco, Seattle, St. Louis

Flanged and Dished Boiler Heads.

Saddles, Manholes, Furnace Holes, etc.

WORTH BROS CO.

MANUFACTURERS

COATESVILLE, PA.

U. S. A.

Irregular Heads for Marine Work.

Boiler Tubes Steel Plates and Sheets.

Seneca Steel Sheets

made of the best selected bars

in

BLACK, GALVANIZED CORRUGATED AND FORMED ROOFING

The brand that stands for quality

Seneca Iron & Steel Co. BUFFALO, N. Y.

Steel for Service

Disk

The first solid steel wheels made by Charles T. Schoen on October 5, 1903, were made from cast steel slabs. Later wheels were forged and rolled from rolled steel slabs.

In spite of defects due to imperfections in equipment and methods of manufacture, these early wheels gave most excellent service and some of them attained to phenomenal runs. This demonstrated the merits of the solid rolled steel wheel.

Since the Carnegie Steel Company engaged in the manufacture of rolled steel circular sections, particular attention has been paid to the selection of material and to improvements in equipment and methods of manufacture. In consequence, these products are now made exclusively from circular blooms cut to suitable lengths (disks), by whose use the very best distribution of metal in the finished product is attained.

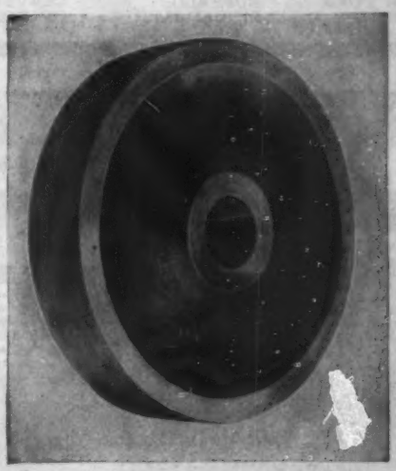
Carnegie-Schoen Steel Wheels for railway purposes and the **Carnegie-Slick Circular Products** for railway and industrial uses represent the very best in modern methods of manufacture.

Particular attention is called to the Carnegie

Rolled Steel Gear Blank

This product is characterized by all the excellencies of the rolled steel circular sections, proper distribution of material, excellent wearing qualities and toughness. Service tests demonstrate their high endurance under most severe operating conditions.

Do not fail to specify them on orders for new equipment. Our experts will be pleased to consult with you as to particular requirements.



Finished Gear Blanks

The mark of quality

It protects the user

Carnegie Steel Company

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757

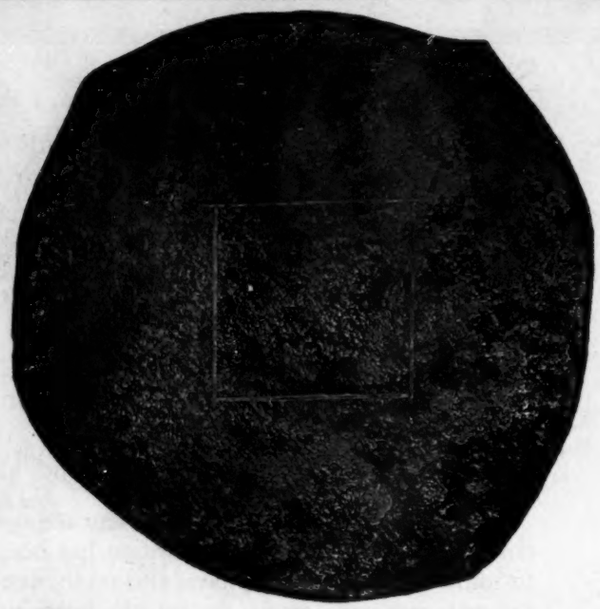
Steel for Drop Forgings

This was a piece of our drop forging steel 4 1/8 inches long from a 1 3/4 by 1 3/4 in. bar (original size indicated by white square). The amount of upsetting shown developed no evidence of flaw or weakness.

Our output is constantly tested in all stages of manufacture for chemical and physical uniformity, hence drop forgings from Lackawanna steel show no variation in quality.

We also make steel plates; structural shapes; standard, heavy and light rails; track bolts and spikes; and Lackawanna Steel Sheet Piling.

Let us quote on your requirements.



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MAKING GOOD STEEL BETTER—No. 6

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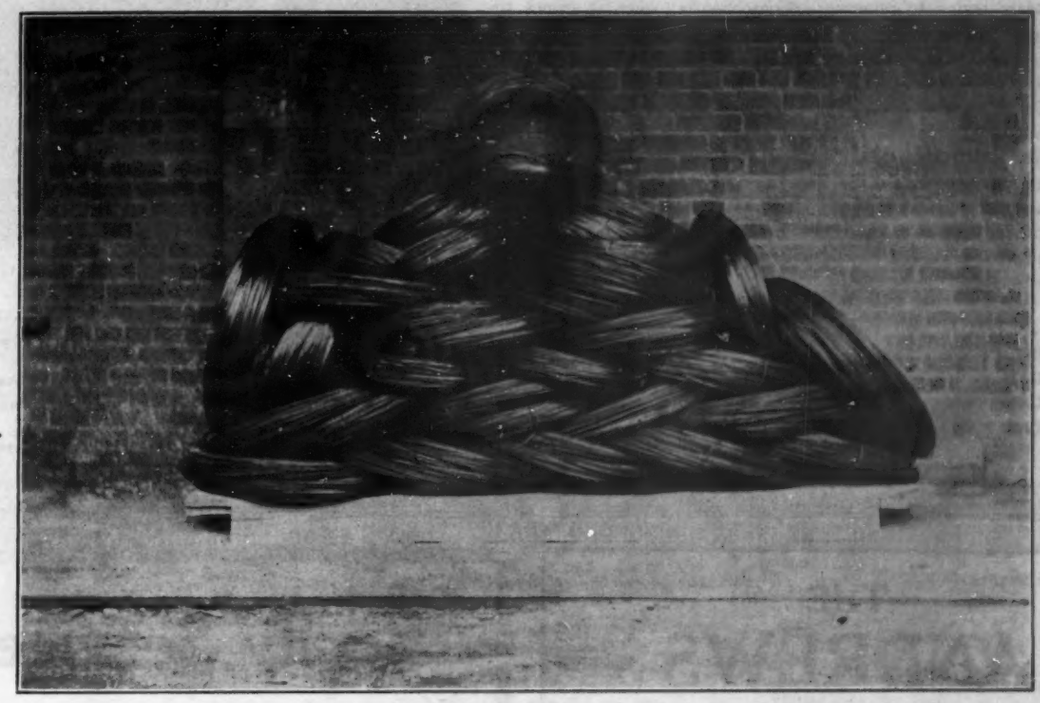

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The amount of **Ferro Carbon-Titanium** used varies according to conditions which present themselves in different heats; but about six pounds to the gross ton is the average quantity added at this progressive plant.

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Rolling Muck Bar

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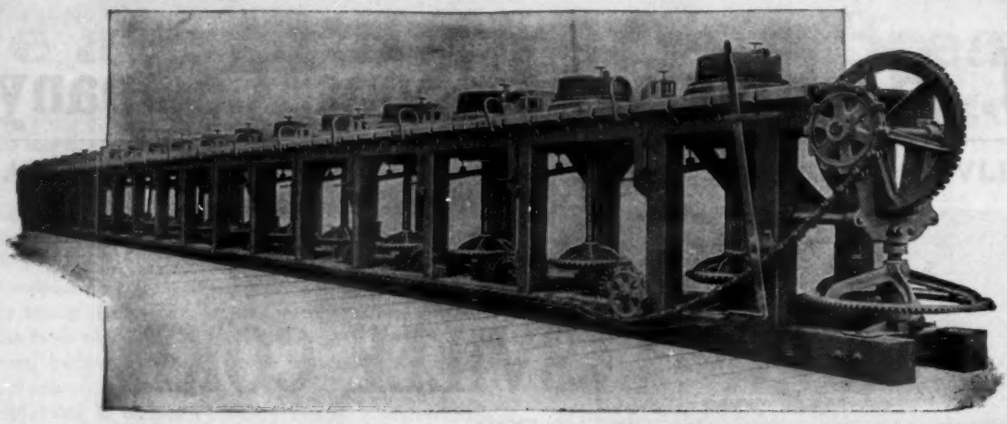

Like all other units of Vaughn Wire Mill Equipment, this Timber Rod Frame is by far the most efficient machine of its kind ever designed.

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It presents many new subjects, principles and ideas—none, however, that have not been tried satisfactorily by the author. It is void of confusing minutiae and is clearly and forcibly written.

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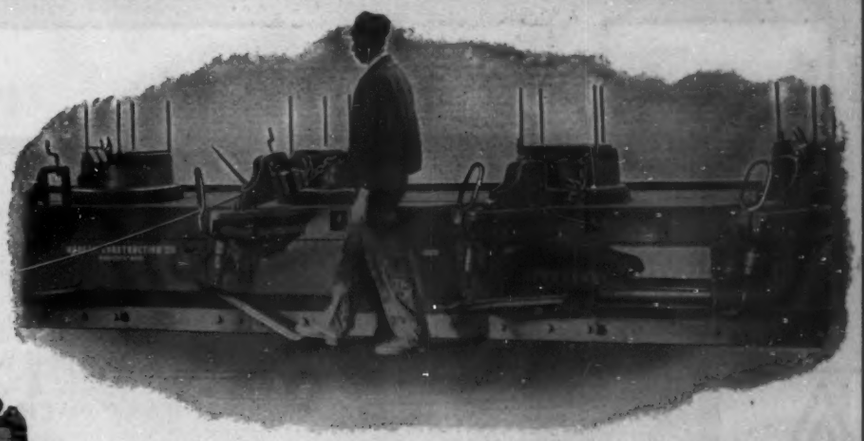
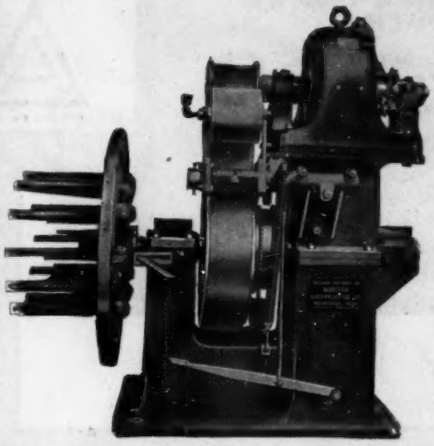


Rod Frame equipped with Carroll Friction Blocks



MILL EQUIPMENT

The above illustration shows one of our heavy rod frames equipped with *Friction Blocks*. Enclosed within each block is a coil clutch. We equip each block with an automatic safety stop.

No draw-out mechanism is required, and the machine is characterized by high efficiency and low maintenance costs.

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The workmen below, forget the heavy loads that swing about over their heads, if the loads are supported by Excelsior Wire Rope—for they have learned that "Excelsior" is always dependable.

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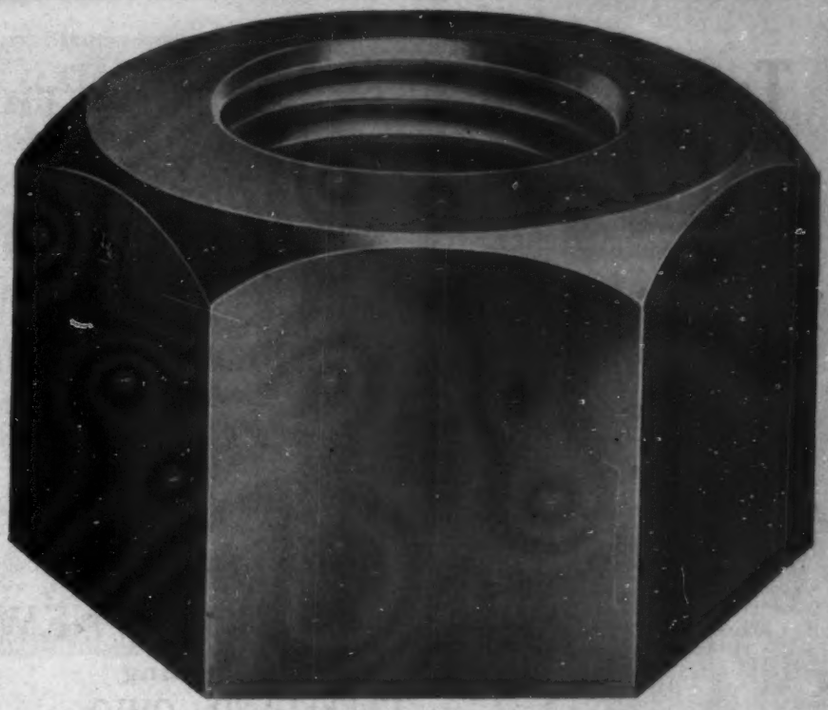

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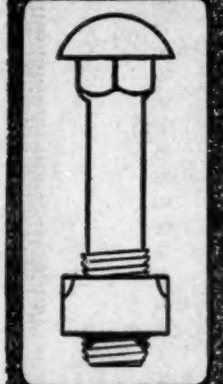

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Machine, Carriage, Track and Bridge Bolts
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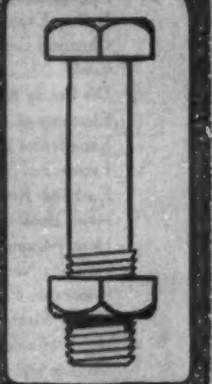

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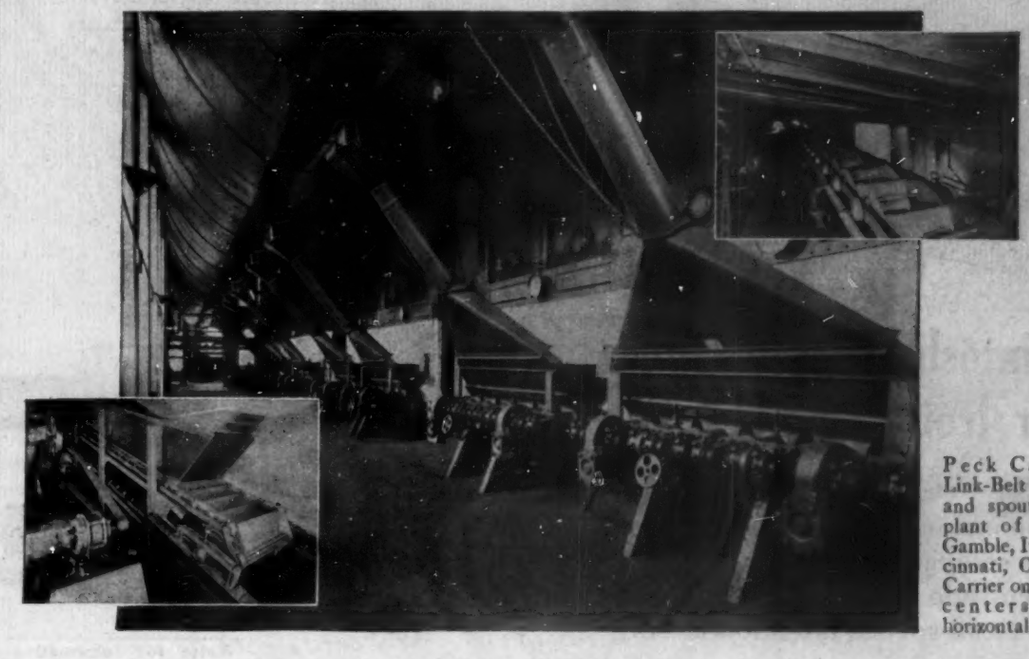

Peck Carrier and Link-Belt bunker, gates and spouts in boiler plant of Procter & Gamble, Ivorydale, Cincinnati, Ohio. Peck Carrier on 42 ft. vertical centers and 174 ft. horizontal centers.

Procter & Gamble
Manufacturers of
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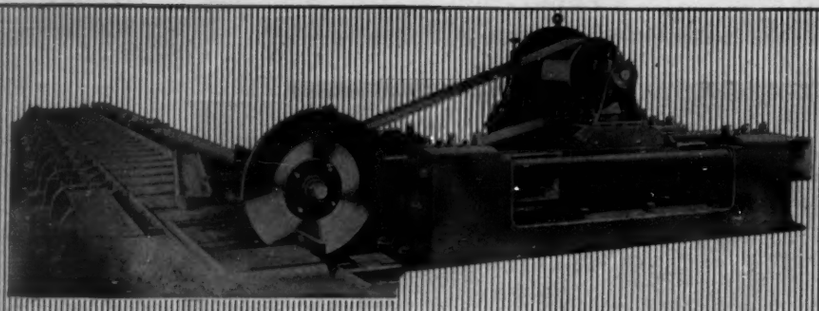
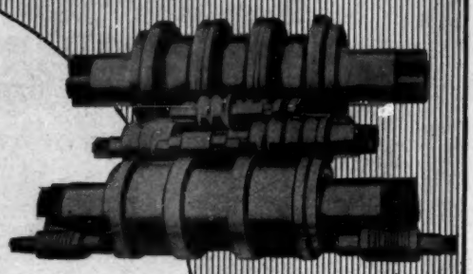
Toronto..Canadian Link-Belt Co., Ltd.



Horizontal Saw for heavy sections, hot or cold.

Mackintosh-Hemphill Equipment for Iron and Steel Works



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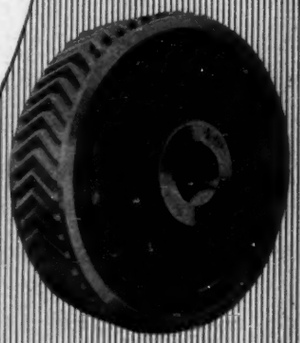

Steel Casting Helical Gear Rim mounted on Steel Casting Center.

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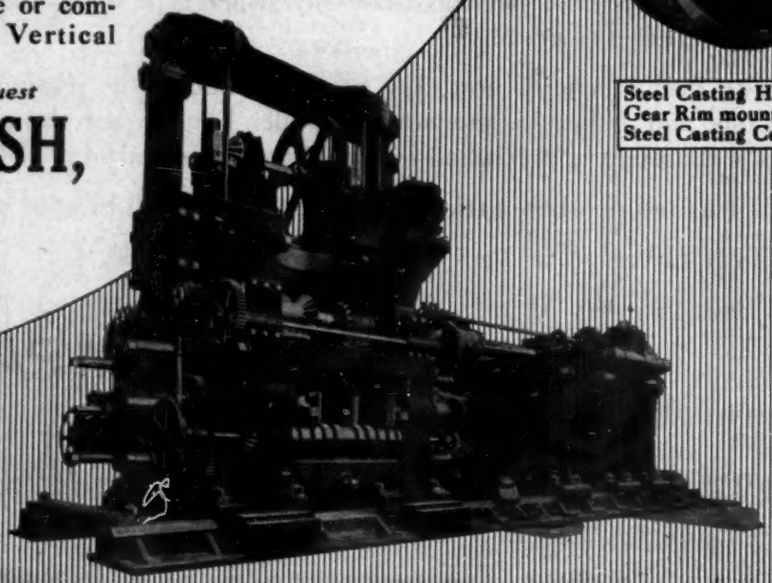
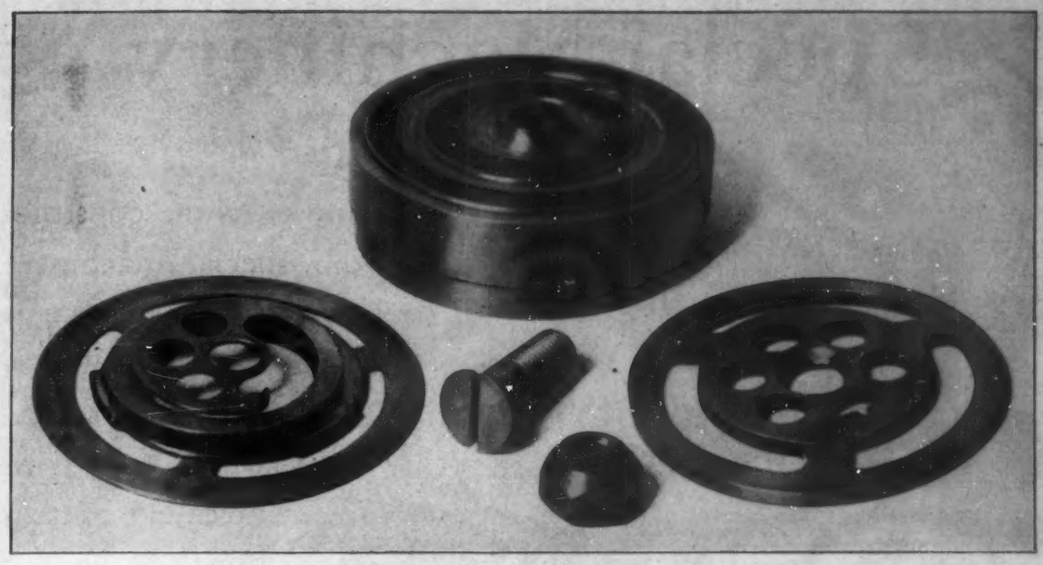


27-inch Universal Plate Mill, built for the Youngstown Sheet and Tube Co.



PARTS OF A MESTA AUTOMATIC PLATE VALVE
(IVERSEN PATENT)

Simplicity

AMONG the main features that have aided in the success of the MESTA AUTOMATIC PLATE VALVE (Iversen Patent) is extreme simplicity. The valve has only one movable part, the valve plate, which is guided in its motion entirely by the spring. There are no sliding or rubbing surfaces hence lubrication is unnecessary.

THIS valve has the maximum possible effective free area for a given diameter and requires a minimum of energy for operation. These qualities are largely responsible for the high volumetric and mechanical efficiencies obtained in operation.

FOR information regarding the installation of these valves on existing blowing engines and air compressors,

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Designers and Builders of

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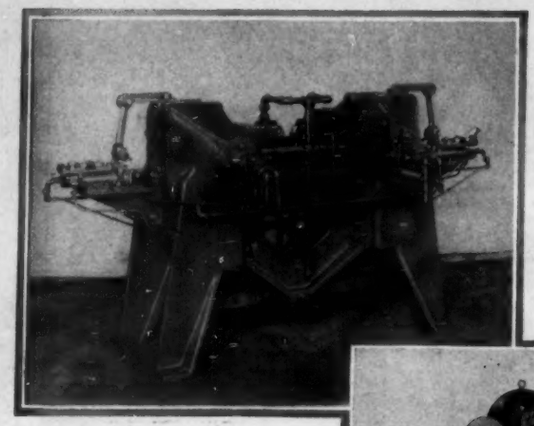

By intrusting to us the construction of your special machinery you are insured that all the steps in its manufacture—drawings, patterns, castings and machine work, will be given close attention.

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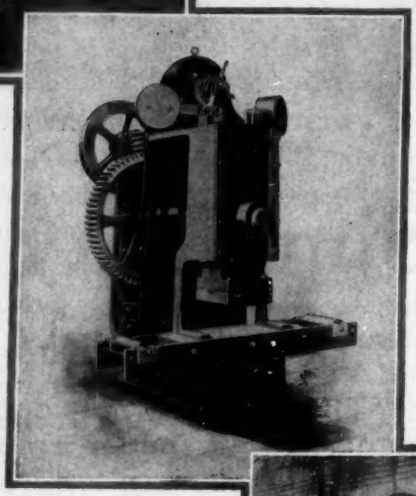
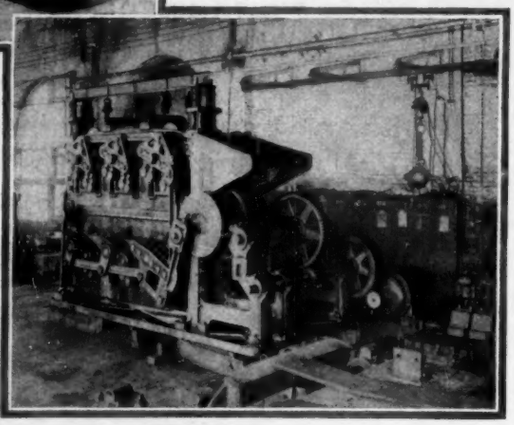


The problem of transportation alone limits the size of the units we can build. No job is too large for us to handle—or too small to have our best attention. Fifty-seven years of experience as designers, engineers, founders and machinists is at your service.



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Rolling Mills Special Machinery Hydraulic Forging Presses
IRON and BRASS CASTINGS

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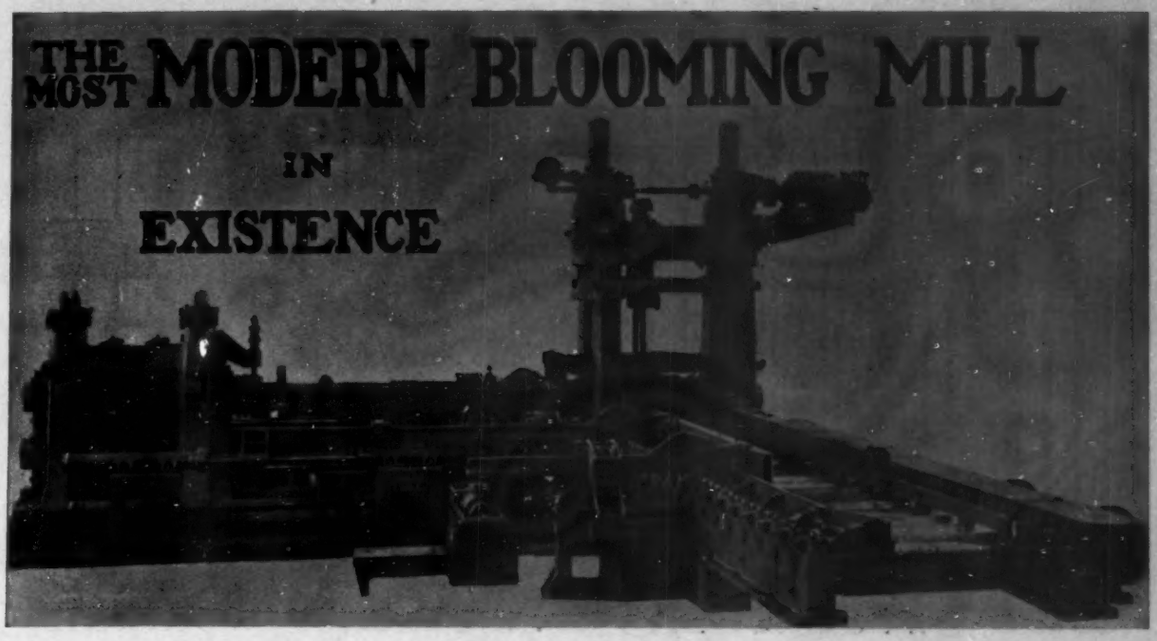

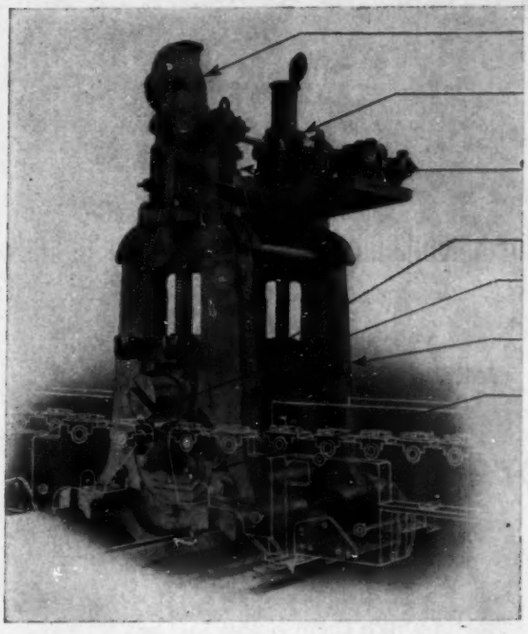

Index may be mounted on housing or pulpit as desired.

Screw-down operated by inclosed worm gearing—screws never back up—top roll raised at a speed of 12 to 15 feet per min.

Hydraulic roll balance self-equalizing—no bolts to work loose (see above illustration).

Water-box in carrier frame.

Universal coupling on vibrating spindle—no back lash.

Patented "A" frame housing avoids table rollers supported on housing.

Semi-circular cradle prevents casting strains in housing.

All table rollers operated by continuous line shaft—no special gearing at mill

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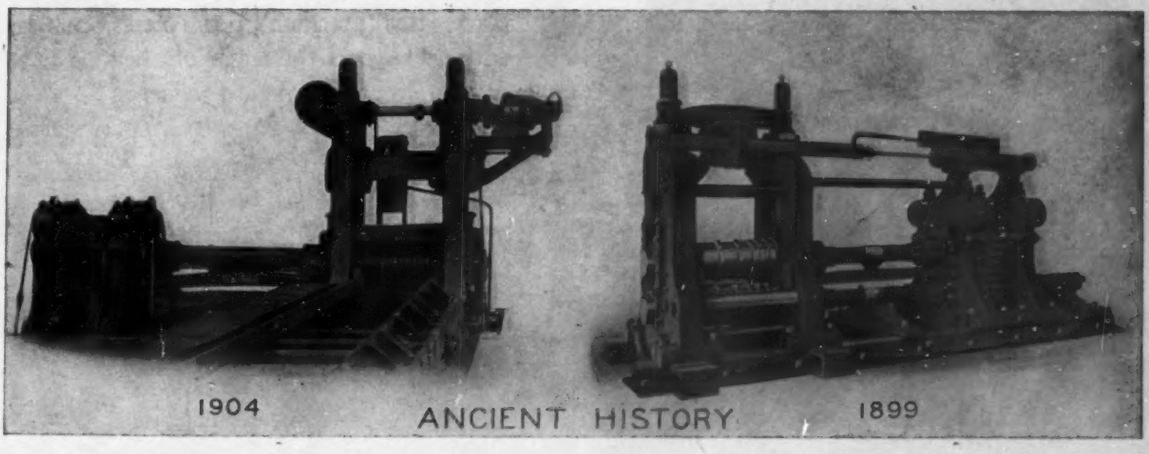
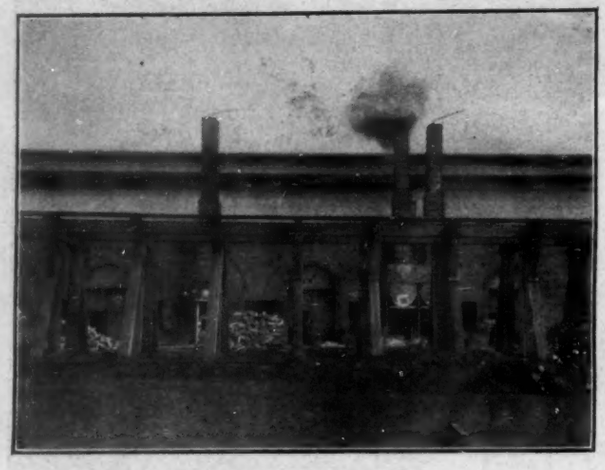
Builders of complete machinery equipment for iron, steel and tube works; steel castings; machine molded gears; forging presses, steel, sand, chilled and "Adamite" rolls.

"Largest roll makers in the world, makers of the largest rolls."



POWDERED COAL EQUIPMENT



Showing Puddle Furnace Stack Condition.

The three furnaces are on heat.

The two furnaces whose stacks are not emitting smoke, are fired with powdered coal—the other is hand fired.

This is characteristic of the two conditions.

Metals Production Equipment Company

Successors to QUIGLEY FURNACE & FOUNDRY CO.

ENGINEERS AND CONTRACTORS

Builders of Overfired Accurate Temperature Heat-Treating Furnaces and Forging Furnaces, (Oil, Gas and Coal Fuel) Powdered Coal Equipment. Brass Rolling Mill Products; Gray Iron Castings.

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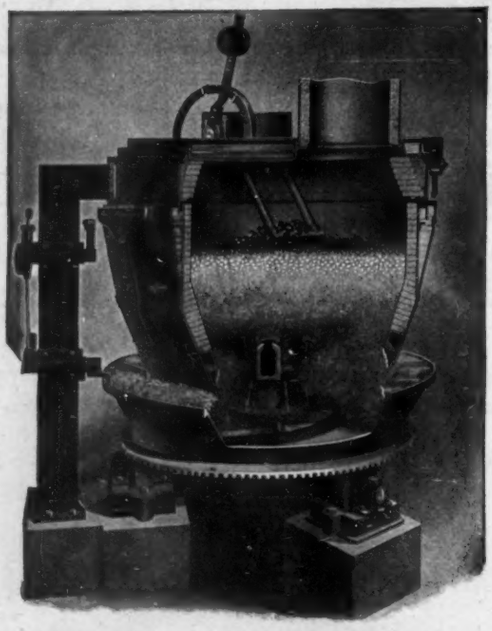
First National Bank Bldg., Chicago :: :: :: :: Works:—Springfield, Mass.



Have you seen those remarkable continuous records made by the

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Nothing like them before. They place this machine in a class entirely beyond the reach of the ordinary mechanical gas producer.

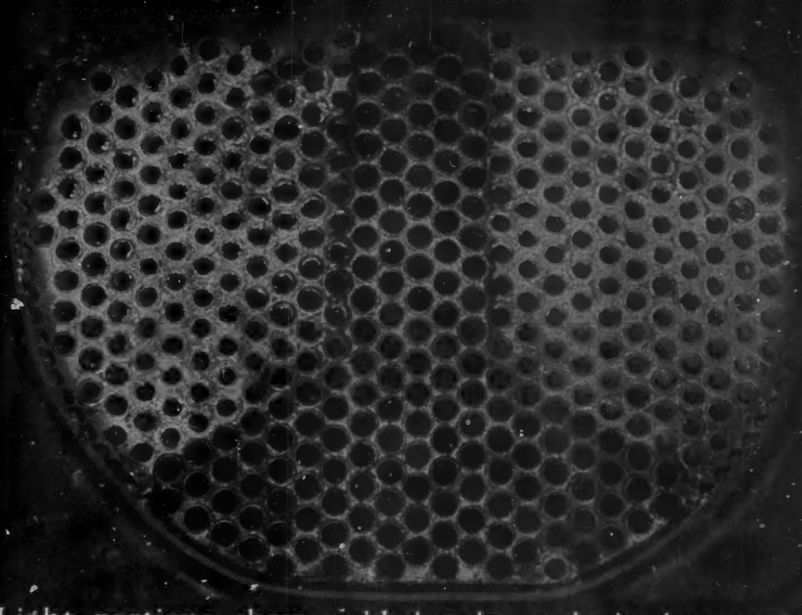
Capacity, Gas Quality, Freedom from Labor and Economy of Installation are all increased to a surprising degree.

See new Catalogue by the

Morgan Construction Company

Worcester, Mass.

Carbon electrode used for cutting or heavy current welding



Metal electrode builds up or fills cavities when welding

Light portions show welded tube ends in locomotive

BENEATH the C and O Locomotive illustrated above, which has welded seams and flue sheets, is shown a partly completed locomotive flue sheet. The light portions show flue ends which have been welded by a G-E arc welding outfit, one type of which, used by the American Locomotive Company, is shown at the bottom of this page.

This welder does its own chipping, so work can go on when your chippers are busy elsewhere.

The control of heat and building of metal possible with this welder prevents distortion, uneven crystallization and cavities.

A G-E Arc Welder will repair worn or broken parts while they are in place.

Our nearest office will be pleased to give you additional information.

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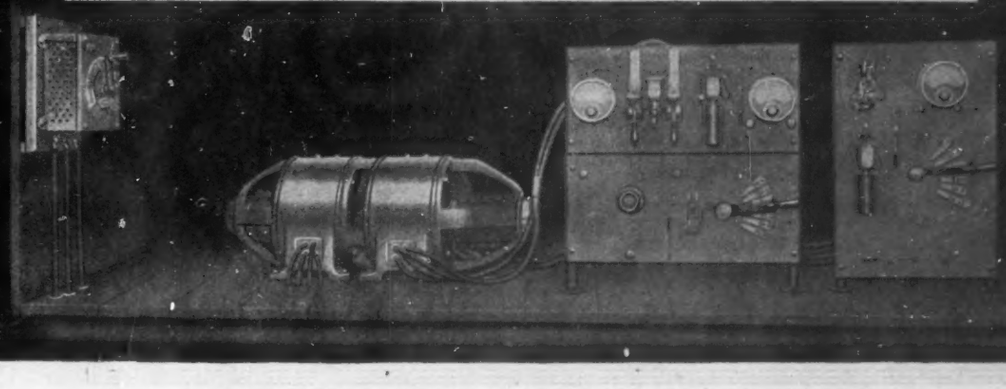

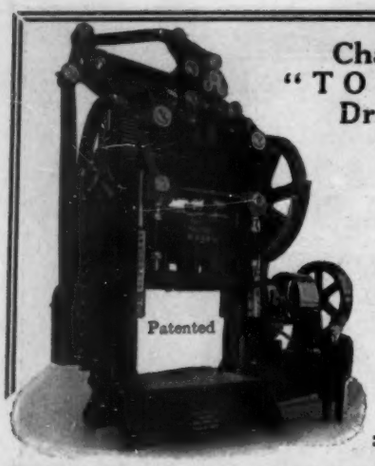

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An all steel, fool proof Toggle Mechanism, unequaled in efficiency and smoothness of action; in the blank holding pressure it exerts; in perfect timing and silent running.

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The Toledo Machine & Tool Co., Toledo, Ohio

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Table of Contents

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How to Determine the Value of Iron Ore—by George Smart.
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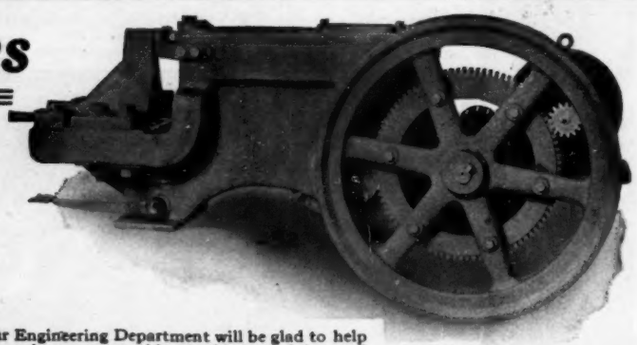
Horizontal Punches



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We build a complete line of high grade punches and shears and our catalog illustrates and describes them in detail. Send for a copy. Cleveland means quality and economy.

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Hydraulic Accumulator, 15" diameter plunger, 15' stroke, 1500 lbs. per square inch pressure.

Presses, Accumulators, Pumps, Rolling Mill Machinery, Jackson Belt Lacing Machines and Blast Furnace Castings.

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The value of the adjustable and dumping cages will be appreciated when the necessity arises for quickly cleaning out the crusher, which, due to the blowing of a fuse, or the jumping of the belt, has filled up with uncrushed coal. Every operator knows what a mess and job it is to clean out the ordinary crusher, and how much valuable time is lost.

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These cages are also adjustable towards the hammer points, permitting the operator to maintain the point of contact at all times, which insures uniformity of product, increased capacity, and longer life of parts.

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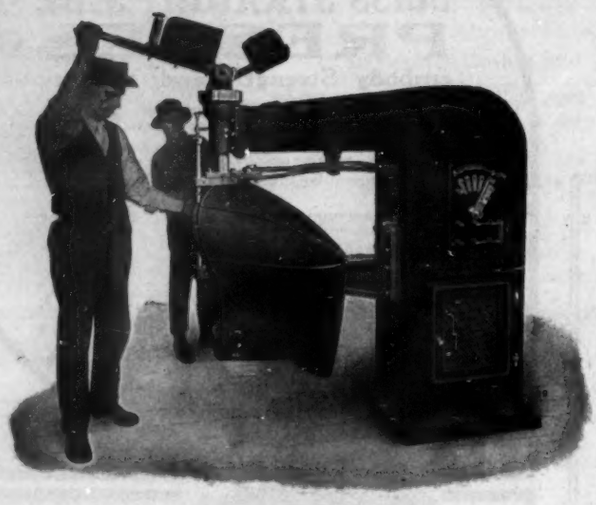

No. 154 Welder, 36-inch throat

The large daily output of many manufacturers of automobiles and auto parts, has been made possible by the use of the "TOLEDO" electric welder shown herewith. With the increased output of their products, *costs have been reduced from 60 to 95 per cent.*

We will prove this by shipping you a "TOLEDO" on 30 days' trial.

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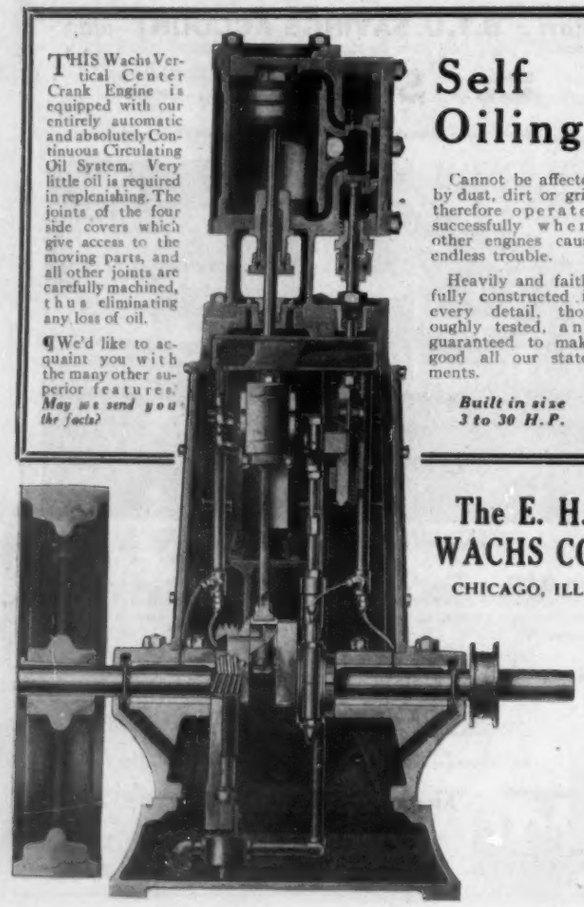
THIS Wachs Vertical Center Crank Engine is equipped with our entirely automatic and absolutely Continuous Circulating Oil System. Very little oil is required in replenishing. The joints of the four side covers which give access to the moving parts, and all other joints are carefully machined, thus eliminating any loss of oil.

¶ We'd like to acquaint you with the many other superior features. *May we send you the facts?*



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Cannot be affected by dust, dirt or grit, therefore operates successfully where other engines cause endless trouble.

Heavily and faithfully constructed in every detail, thoroughly tested, and guaranteed to make good all our statements.

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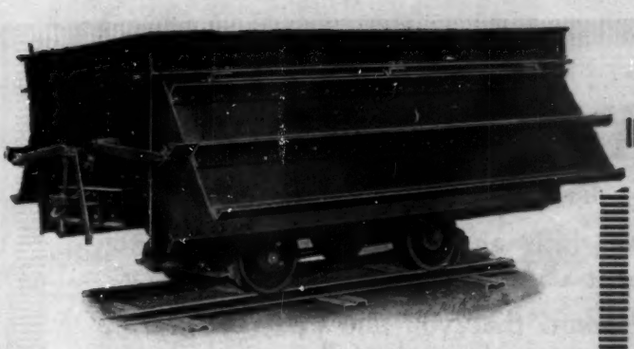
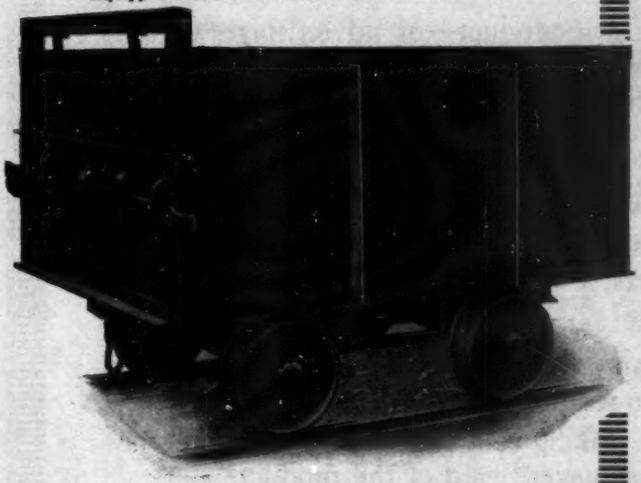
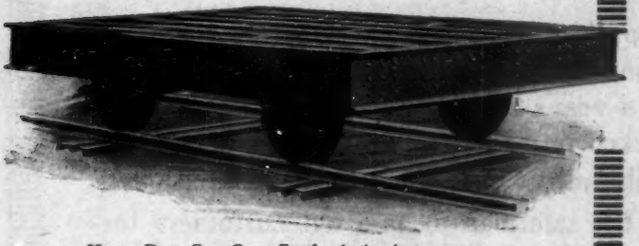


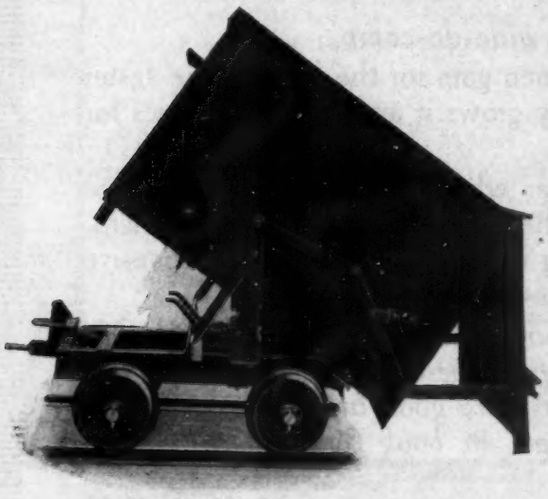
Gable Bottom Dump Car for general use. Automatic doors dump load on both sides of track. Equipped with brake on all four wheels.



Quarry Car. Popular for handling stone, rock and other similar materials. It is of very rigid construction and will stand up under constant service.



Heavy Duty Core Oven Car for drying large cores and conveying heavy castings, etc. Also used by large tool companies as an annealing car.



Rotary Mine Car. Swinging end gate operates automatically as body of car tilts. Very convenient for handling either dry or wet material.

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Not Only *Greater Convenience* but also *Greater Service!*

For 18 years we have specialized on small steel cars and trucks for all kinds of industrial service.

Our successful experience in solving the problems of ***hundreds*** of concerns, will prove invaluable to ***you.***

Let our Engineering Department help you determine just what type of car or truck will best fill your requirements.

The service we can safely say will save you a considerable amount of money, and get you more efficient results.

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CLEVELAND, OHIO

Keep This In Mind—You Can Use It Often.

By Ernest V. Madison

ABOUT the only arguments we ever hear against advertising are those that it is a waste of money and that it adds to the selling price.

Let's agree with the last point. Let's admit that you and I pay the cost of advertising. Then let's use this admission to show the fallacy of the other argument.

As a matter of fact the cost of marketing a product—of advertising—of selling—and of packing—are always borne by the users. So are the costs of material and of manufacture. And furthermore, we pay the manufacturer his profit.

Therefore any method which reduces the cost of making and marketing a product is a benefit to us even though we do pay its cost.

A little clear thought will convince us that technical advertising has chopped off much cost in selling technical products.

In what way?

How much time does the salesman of an unadvertised technical product need to explain its construction, principle of operation, uses and performances?

How much time does a salesman use in making calls where the buyer will not see him because he, THE BUYER, has never heard of the product?

How much salary is paid to this salesman? Usually when added to his expense money it reaches a considerable figure.

Now the cost of the time used and *wasted* by the salesman of an unadvertised technical article in endeavoring to obtain an interview and in making the article known totals into a good round sum in a year's time. This sum must be repaid to the manufacturer. It is therefore tacked on to the selling price.

We pay it. We pay extra for this snaily, musty method of growing a business.

The technical paper advertisement aids the salesman to gain ten customers for his firm with the effort he would use to convert one man's trade through unaided personal solicitation.

Technical paper advertising is the salesman's *aide-de-camp.*

We know that the more customers the salesmen gain for the factory, the faster that factory grows. Also that as the factory grows it arranges its facilities for production at a lower cost per *article.*

Bear this in mind and spring it on the salesman who next comes into your office boasting that his firm does not advertise—and therefore can quote you lower prices. Tell him why you know technical advertising is the shortest and least expensive method of introduction of manufacturer to his trade.

And then tell him you believe his firm should advertise in THE IRON TRADE REVIEW. Let him know that you believe in the paper which gives you for Four Dollars ($4.00) a year more good information on Iron and Steel subjects than you could purchase in book form for a hundred times that amount.

CLEVELAND, OHIO, JUNE 29, 1916

THE IRON TRADE REVIEW

A weekly publication devoted to the Iron, Steel, Machinery and Foundry Industries of the United States and Canada.

Published Every Thursday by THE PENTON PUBLISHING Co., Cleveland.

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Though the market is full of all kinds of safety devices, experience has taught the employer that these are well nigh ineffective without the interest and co-operation of the workers themselves. Mr. Mix tells how the employes of a large factory were stimulated to do their share in promoting the interests of safety.

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CLASSIFIED ADVERTISEMENTS, PAGES 144-149

BRANCH OFFICES

CHICAGO - -	1521-23 Lytton Bldg.	PITTSBURGH - - -	2148-49 Oliver Bldg.
CINCINNATI - -	404 Johnston Bldg.	WASHINGTON, D. C. -	206 Corcoran Bldg.
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Subscription, United States and Mexico, $4 per year. Canada, $6, and other Foreign Countries, $8 per year.

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Could We Do It If We Lied

Just to give you an idea of how the Ridgway Elevator is considered by those who know it;

Just to give you an idea of what you miss if you have boilers full of steam;

Just to give you an idea how "engineers" who are not up to date can "sting" their clients—

We open a single page of our order book. Just listen while we read the names of a few Big Ones for whom we are making elevators at this writing (June 1st, 1916):

B. F. Goodrich Co., Akron, Ohio—Eight.

E. I. Du Pont de Nemours Co., Wilmington, Del.—Four.

Barrett Mfg. Co., Marcus Hook—Five.

Remington Arms & Ammunition Co., Ilion—Twelve.

Bartlesville Zinc Co., St. Louis—Two.

Lowell Bleachery, Lowell, Mass.—Three.

Welsbach Co., Philadelphia—Five.

United States Tire Co., Mishawaka, Ind.—Four.

American Hard Rubber Co., Akron, Ohio—Three.

All of the above (except one) are already using Ridgway Elevators.

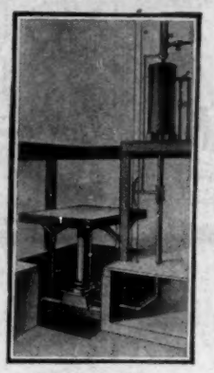
We have many other single elevator orders from all over the land, many of them repeat orders.

Say, you are a man with Brains and Sense.

Do you honestly think this Great Patronage in elevators — Steam-Hydraulic—would come to us if we were not making the greatest thing in elevators the world has ever seen.

Old fellow, wake up and find out why the big concerns are so keen to

"Hook 'er to the Biler"



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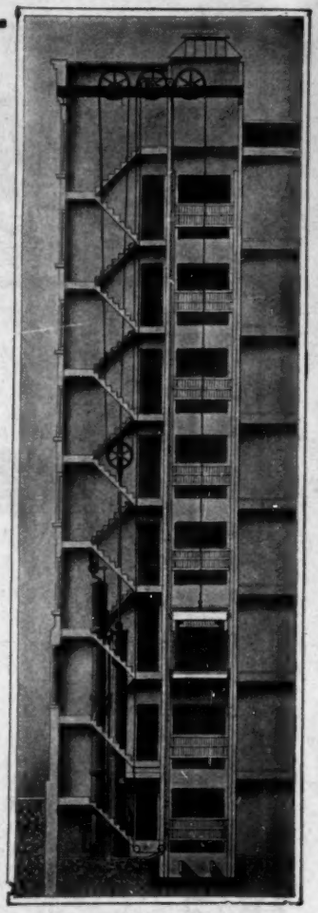
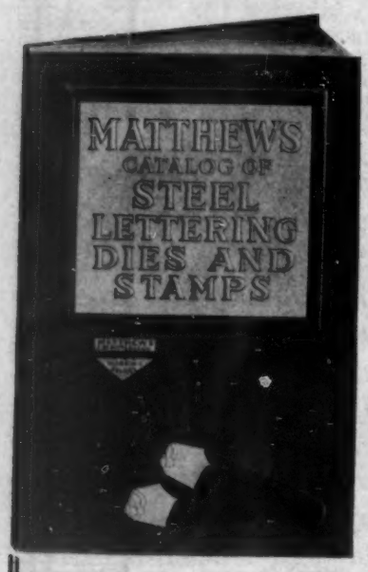
Over 2,000 in Daily Use

Double Geared



CRAIG RIDGWAY & SON
COATESVILLE, PA.
Elevator Makers to Folks Who Know



Learn more about steel stamping methods and devices from this

MATTHEWS CATALOG

It will show you a few of the many steel lettering dies and stamps which we manufacture.

It will also explain to you how we operate the largest and most modernly equipped shop in the United States for manufacturing all classes of steel lettering dies and kindred marking devices.

Through this catalog we wish to invite inquiries and orders in this line, assuring you of prompt deliveries and efficient service.

Where shall we send it?

JAMES H. MATTHEWS & COMPANY
Address Department "C"
Established 1850 **Pittsburgh, Pennsylvania**
The oldest, largest and best equipped Factory of its kind in the United States

"The Grip that won't give way"

Once attached to a barrel or keg

CO-Z Cleats

are bound to hold, even under the most severe kind of handling

Like an anchor of a ship, they are made to hold in the supreme test.

In the storm of shipping, CO-Z CLEATS hold their cargo safe and secure.

CO-Z CLEATS are not an experiment — ***millions*** of them are in actual use.

Hours of time are saved — it takes but five seconds to place a CO-Z CLEAT onto a barrel.

Both domestic and Export shippers all over the country are using them.

They are made to fit any standard size barrel or keg.

Write for prices and samples

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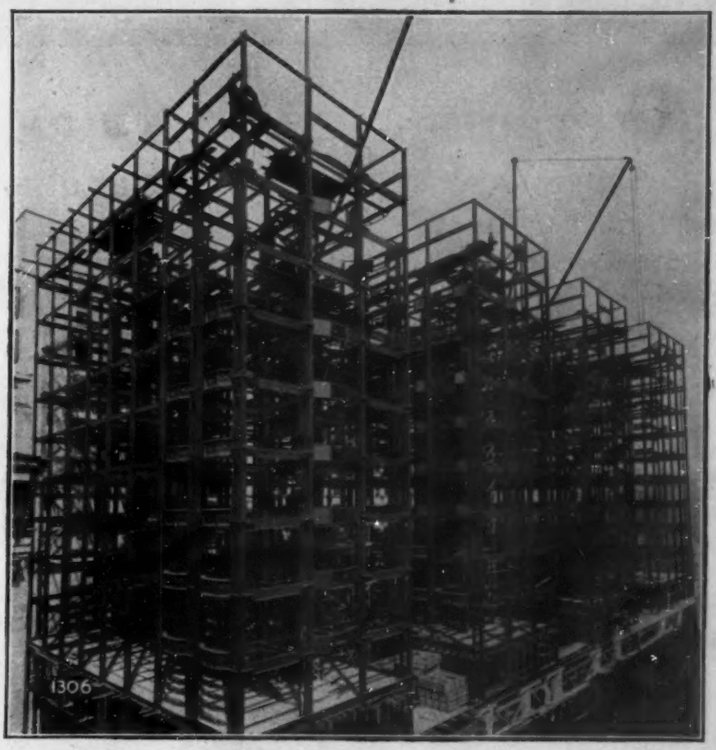
Stamping Dept.

AMERICAN BRIDGE COMPANY
HUDSON TERMINAL-30 CHURCH STREET, NEW YORK

Manufacturers of Steel Structures of all classes particularly BRIDGES AND BUILDINGS



Little's Building, Boston, Mass.

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When you're ordering pipe, it's just as easy to specify "La Belle" pipe and get the very best.

"La Belle threads are perfect."

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LA BELLE IRON WORKS

General Offices — Steubenville, Ohio

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Works: Steubenville, O.

Ryerson Steel-Service

insures the buyer against delay on account of material.

Bars Plates Rivets Tubes Nuts Tool Steel
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and a thousand and one other items in the Iron and Steel line with

IMMEDIATE SHIPMENT GUARANTEED

Take advantage of combined low freight rate shipments. 72 years of service to the trade assures absolute reliability, accuracy and speed.

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JOHNSON LUMBER CO.

White Pine Pattern and Crating, Boxing

WRITE US TODAY

Templet Lumber and Flask Stock

MILWAUKEE, WISCONSIN

"BUFLOKAST"

Quality and Service

When you specify "BUFLOKAST" you know that you are guaranteeing yourself a *quality* and a *service* upon which no improvement could be made.

Our unsurpassed foundry facilities; our thoroughly equipped, up-to-date chemical and physical testing laboratories; our model organization of experienced and scientific metallurgists—all these things are ABSOLUTELY AT YOUR SERVICE.

When we undertake to satisfy you, we see that you *are* satisfied.

Before making your castings, we first determine the metal which our laboratory research and manufacturing experience shows to be the best suited for your particular purpose.

Let us show you what we are doing for others.

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Tube Mill Machinery (Seamless and Welded)
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Pipe Threading Machinery
Castings—gray iron, semi-steel, cupola, and Air Furnace
Machine work to drawings

HYDRAULIC PRESS FOR CRUSHING SCRAP PIPE

Say you saw it in THE IRON TRADE REVIEW

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General Electric Co., Schenectady, N. Y.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Roots, P. H. & F. M., Co., Connersville, Ind.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

BOILER HEADS.
(Flanged and Dished.)
Worth Brothers Co., Philadelphia, Pa.

BOILER HEADS.
(Irregular for Marine Work.)
Worth Brothers Co., Philadelphia, Pa.

BOILER INSULATION.
Armstrong Cork & Insulation Co., Pittsburgh.

BOILER SETTINGS.
Eureka Fire Brick Works, Mt. Braddock, Pa.

BOILER TUBES.
Detroit Seamless Steel Tubes Co., Detroit, Mich.
National Tube Co., Pittsburgh, Pa.
Worth Brothers Co., Philadelphia, Pa.

BOILER TUBES.
(Seamless Steel.)
Detroit Seamless Steel Tubes Co., Detroit, Mich.
National Tube Co., Pittsburgh, Pa.

BOILERS AND SUPERHEATERS.
Babcock & Wilcox Co., The, New York City.
Phoenix Iron Works Co., Meadville, Pa.
Vulcan Iron Works, Wilkesbarre, Pa.

BOLT AND NUT MACHINERY.
Baker Bros., Toledo, O.
Landis Machine Co., Waynesboro, Pa.
National Machinery Co., Tiffin, O.
Newton Mach. Tool Works, Inc., Philadelphia.
Williams Tool Co., Erie, Pa.

BOLTS AND NUTS.
American Bridge Co., New York City.
American Iron & Steel Mfg. Co., Lebanon, Pa.
Beals & Company, Buffalo, N. Y.
Bourne-Fuller Co., Cleveland, O.
Clark Bros. Bolt Co., Millidale, Conn.
Lockhart Iron & Steel Co., Pittsburgh, Pa.
Milton Mfg. Co., Milton, Pa.
Oliver Iron & Steel Co., Pittsburgh, Pa.
Republic Iron & Steel Co., Youngstown, O.
Rockford Bolt Co., Rockford, Ill.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Ryerson, Jos. T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.
Upson Nut Co., Cleveland, O.

BORING AND TURNING MACHINES.
Baker Bros., Toledo, O.
Cincinnati Planer Co., Cincinnati, O.
Espen-Lucas Machine Works, Philadelphia, Pa.
Mitts & Merrill, Saginaw, Mich.
Newton Mach. Tool Wks., Inc., Philadelphia.
Niles-Bement-Pond Co., New York, N. Y.
Warner & Swasey Co., Cleveland, O.

BRAKES.
(Electric.)
Cutler-Hammer Mfg. Co., The, Milwaukee, Wis.
Electric Controller & Mfg. Co., Cleveland, O.
General Electric Co., Schenectady, N. Y.
Toledo Bridge & Crane Co., Toledo, O.

BRAZING OUTFITS.
Prest-O-Lite, The, Co., Indianapolis, Ind.

BRICK.
(Silica, Magnesia, Chrome.)
American Refractories Co., Chicago, Ill.
Kier Fire Brick Co., Pittsburgh, Pa.
Soisson, Jos., Fire Brick Co., Connellsville, Pa.
Union Mining Co., Mt. Savage, Md.

BRICK INSULATING.
Armstrong Cork & Insulation Co., Pittsburgh.
Kieselguhr Co. of America, New York City.

BRIDGES.
(Suspension.)
Roebling's, John A., Sons Co., Trenton, N. J.

BRIDGES, BUILDINGS AND VIADUCTS.
(Steel.)
Alliance Structural Co., Alliance, O.
American Bridge Co., New York, N. Y.
Bellefontaine Bridge & Steel Co., The, Bellefontaine, O.
Blaw Steel Construction Co., Hoboken, Pa.
Eichleay, John, Jr., Co., Pittsburgh, Pa.
Frazier & Sheal Co., Cleveland, O.
McClintic-Marshall Co., Pittsburgh, Pa.
McMyler Interstate Co., Cleveland, O.
Mt. Vernon Bridge Co., Mt. Vernon, O.
Riter-Conley Mfg. Co., Pittsburgh, Pa.
Westinghouse-Church-Kerr & Co., New York.

BROKERS.
(Pig Iron.)
Wheeler, Chas. Child, New York City.

BRONZE.
(Manganese.)
American Manganese Bronze Co., Holmesburg, Philadelphia, Pa.
Bethlehem Steel Co., The, So. Bethlehem, Pa.

BRUSHES.
(Dynamo.)
Dixon, Jos., Crucible Co., Jersey City, N. J.

BUCKETS.
(Cotton Tie.)
Hubbard & Company, Pittsburgh, Pa.

BUGGIES.
(Wire.)
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

BULLDOZERS.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Watson-Stillman Co., New York, N. Y.

BUNDLERS—SCRAP, WIRE AND ROD.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

BURNERS.
(Acetylene.)
Prest-O-Lite, The, Co., Indianapolis, Ind.

BURNERS.
(Fuel Oil.)
Gilbert & Barker Mfg. Co., Springfield, Mass.

BUSINESS CARDS.
(Engraved.)
Wiggins, John B., Co., Chicago, Ill.

BY-PRODUCT COKE OVENS.
Koppers, H., Co., Pittsburgh, Pa.

CABLEWAYS AND TRAMWAYS.
American Steel & Wire Co., Chicago, Ill.
Brown Hoisting Mchy. Co., Cleveland, O.
McClintic-Marshall Co., Pittsburgh, Pa.
Roebling's, John A., Sons Co., Trenton, N. J.

CABLE WIRE.
Wright Wire Co., Worcester, Mass.

CANS.
(Waste, Shop and Oil.)
New Britain Mach. Co., New Britain, Conn.

CARS.
(Industrial and Mining.)
American Bridge Co., New York, N. Y.
Atlas Car & Mfg. Co., Cleveland, O.
Cambria Steel Co., Philadelphia, Pa.
Chase Fdy. & Mfg. Co., Columbus, O.
Lakewood Engrg. Co., Cleveland, O.
Mesta Machine Co., Pittsburgh, Pa.
Whiting Fdy. Equipment Co., Harvey, Ill.

CASE HARDENING.
Bidle, W. S., Co., Cleveland, O.

CASTINGS.
(Air Furnace.)
Mesta Machine Co., Pittsburgh, Pa.
Tod, Wm., Co., Youngstown, O.

CASTINGS.
(Alloy Steel.)
Sivyer Steel Castings Co., Milwaukee, Wis.

CASTINGS.
(Brass, Bronze and Aluminum.)
American Manganese Bronze Co., Holmesburg, Philadelphia, Pa.
Arcade Mfg. Co., Freeport, Ill.
Bellefonte Engineering Co., Bellefonte, Pa.
Dake Engine Co., Grand Haven, Mich.
Hill Pump Valve Co., Chicago, Ill.
Klotz Machine Co., Sandusky, O.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Scranton Pump Co., Scranton, Pa.
Titanium Alloy Mfg. Co., Niagara Falls, N. Y.
Tod, Wm., Co., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Wellman Bronze Co., Cleveland, O.

CASTINGS.
(Chill.)
McLain's System, Milwaukee, Wis.

CASTINGS.
(Converter Steel.)
Sivyer Steel Casting Co., Milwaukee, Wis.
West Steel Casting Co., Cleveland, O.

CASTINGS.
(Crucible Steel.)
Adrian Steel Casting Co., Adrian, Mich.
Sivyer Steel Casting Co., Milwaukee, Wis.
West Steel Casting Co., Cleveland, O.

CASTINGS.
(Die.)
Atlas Steel Casting Co., Buffalo, N. Y.
Lubricating Metal Co., The, New York City.
Strong Steel Foundry Co., Buffalo, N. Y.

CASTINGS.
(Electric Furnace.)
Belle City Malleable Iron Co., Racine, Wis.
Latrobe Electric Steel Co., Latrobe, Pa.
Racine Steel Castings Co., Racine, Wis.
Sivyer Steel Castings Co., Milwaukee, Wis.
Treadwell Engrg. Co., Easton, Pa.
United Steel Co., Canton, O.

CASTINGS.
(Furnace.)
Marshall Foundry Co., Pittsburgh, Pa.

CASTINGS.
(Gear.)
Dayton Steel Foundry Co., Dayton, O.
Mesta Machine Co., Pittsburgh, Pa.
Sivyer Steel Castings Co., Milwaukee, Wis.
Standard Steel Castings Co., Cleveland, O.
Strong Steel Foundry Co., Buffalo, N. Y.
Taylor-Wilson Mfg. Co., McKees Rocks, Pa.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

CASTINGS.
(Gray Iron.)
Adamson Machine Co., Akron, O.
Allyne-Ryan Fdy. Co., Cleveland, O.
American Bridge Co., New York, N. Y.
Arcade Mfg. Co., Freeport, Ill.
Bethlehem Steel Co., So. Bethlehem, Pa.
Birdsboro St'l Fdy. & Mch. Co., Birdsboro, Pa.
Buffalo Fdy. & Machine Co., Buffalo, N. Y.
Cyclops Foundry Co., Pittsburgh, Pa.
Dake Engine Co., Grand Haven, Mich.
Erie Foundry Co., Erie, Pa.
Farrell Foundry & Mach. Co., Ansonia, Conn.
Klotz Machine Co., Sandusky, O.
Lancaster Foundry Co., Lancaster, Pa.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Marshall Foundry Co., Pittsburgh, Pa.
Metals Production Equipment Co., Springfield, Mass.
Murcott-Duden Co., The, New York City.
National Foundry Co., Erie, Pa.
North Buffalo Hdw. Fdy. Co., Buffalo, N. Y.
Phoenix Iron Works Co., Meadville, Pa.
Scranton Pump Co., Scranton, Pa.
Standard Engrg. Co., Ellwood City, Pa.
Standard Foundry Co., Buffalo, N. Y.
Taylor-Wilson Mfg. Co., McKees Rocks, Pa.
Tod, Wm., Co., Youngstown, O.
Treadwell Engineering Co., Easton, Pa.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
U. S. Cast Iron Pipe & Fdy. Co., Burlington, N. J.
Youngstown Sh't & Tube Co., Youngstown, O.

CASTINGS.
(Malleable.)
Acme Steel & Malleable Iron Wks., Inc., Buffalo, N. Y.
Belle City Malleable Iron Co., Racine, Wis.
Bethlehem Steel Co., So. Bethlehem, Pa.
Columbus Malleable Iron Co., Columbus, O.
Danville Malleable Iron Co., Danville, Ill.
Dayton Malleable Iron Co., Dayton, O.
Erie Malleable Iron Co., Erie, Pa.
General Malleable Co., The, Warren, O.
Illinois Malleable Iron Co., Chicago, Ill.
Lakeside Malleable Castings Co., Racine, Wis.
Marion Malleable Iron Works, Marion, Ind.
Missouri Malleable Iron Co., E. St. Louis, Ill.
Moline Malleable Iron Co., St. Charles, Ill.
National Malleable Castings Co., Cleveland, O.
Northwestern Mall. Iron Co., Milwaukee, Wis.
Pittsburgh Malleable Iron Co., Pittsburgh, Pa.
Pittsburgh Valve Foundry & Const. Co., Pittsburgh, Pa.
Ross-Meehan Foundries, Chattanooga, Tenn.
Standard Malleable Iron Co., Muskegon, Mich.
Wisconsin Malleable Iron Co., Milwaukee, Wis.
Zanesville Malleable Iron Co., Zanesville, O.

CASTINGS.
(Manganese Steel.)
St. Louis Steel Foundry, St. Louis, Mo.
Smith, Geo. H., Steel Casting Co., Milwaukee, Wis.
Strong Steel Foundry Co., Buffalo, N. Y.
Taylor-Wharton Iron & Steel Co., Highbridge, N. J.

CASTINGS.
(Semi-Steel.)
Adamson Machine Co., Akron, O.
Allyne-Ryan Fdy. Co., Cleveland, O.
Buffalo Fdy. & Mch. Co., Buffalo, N. Y.
Pittsburgh Piping & Equip. Co., Pittsburgh.
Tod, Wm., Co., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

CASTINGS, STEEL.
(For Electrical Apparatus.)
Dayton Steel Foundry, Dayton, O.
National Malleable Casting Co., Cleveland, O.
Smith, Geo. H., Steel Casting Co., Milwaukee, Wis.
Strong Steel Foundry Co., Buffalo, N. Y.
West Steel Casting Co., Cleveland, O.

CASTINGS.
(Steel.)
Adamson Machine Co., Akron, O.
American Steel Foundries, Chicago, Ill.
Atlas Steel Casting Co., Buffalo, N. Y.
Bethlehem Steel Co., So. Bethlehem, Pa.
Birdsboro St'l Fdy. & Mch. Co., Birdsboro, Pa.
Dayton Steel Foundry, Dayton, O.
Farrel-Cheek Steel Foundry Co., Sandusky, O.
Federal Steel Foundry Co., Chester, Pa.
Hubbard Steel Foundry Co., E. Chicago, Ind.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Mesta Machine Co., Pittsburgh, Pa.
National Foundry Co., Erie, Pa.
National Malleable Castings Co., Cleveland, O.
Otis Steel Co., Cleveland, O.
Pittsburgh Iron & Steel Foundries Co., Pittsburgh, Pa.
Racine Steel Castings Co., Racine, Wis.
Ross-Meehan Foundries, Chattanooga, Tenn.
St. Louis Steel Foundry, St. Louis, Mo.
Sharon Foundry Co., Sharon, Pa.
Sivyer Steel Casting Co., Milwaukee, Wis.
Smith, Geo. H., Steel Casting Co., Milwaukee, Wis.
Standard Steel Castings Co., Cleveland, O.
Strong Steel Foundry Co., Buffalo, N. Y.
Swedish Crucible Steel Co., Detroit, Mich.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
West Steel Casting Co., Cleveland, O.
Wheeling Mold & Foundry Co., Pittsburgh, Pa.

CASTINGS.
(Vanadium Steel.)
American Vanadium Co., Pittsburgh, Pa.
Sivyer Steel Castings Co., Milwaukee, Wis.
Strong Steel Foundry Co., Buffalo, N. Y.

CEMENT.
(Insulating.)
Kieselguhr Co. of America, New York City.

CEMENT MACHINERY.
Vulcan Iron Works, Wilkesbarre, Pa.

See Index to Advertisements for Pages Containing Advertisements of Companies Listed Above

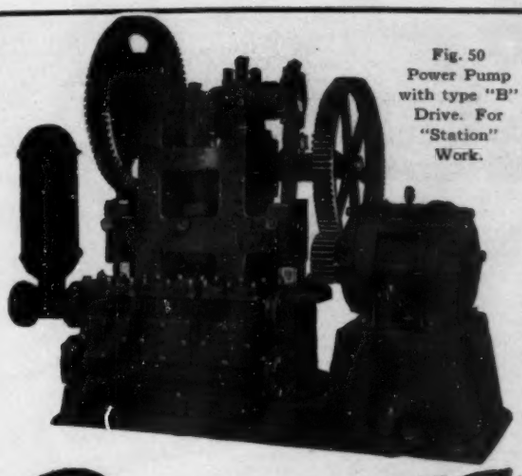

Fig. 50 Power Pump with type "B" Drive. For "Station" Work.

DEMING MINE PUMPS

Are made in portable and stationary types. They may be operated by any power and are adapted to all mine pumping conditions.

Complete catalogue on request.

The Deming Company, Salem, Ohio

Hand and Power Pumps for All Uses

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Harris Pump & Supply Co., 320-322 Second Ave., Pittsburg
Ralph B. Carter Co., 152 Chambers St., New York City
Root, Neal & Co., 178-180 Main St., Buffalo, N. Y.

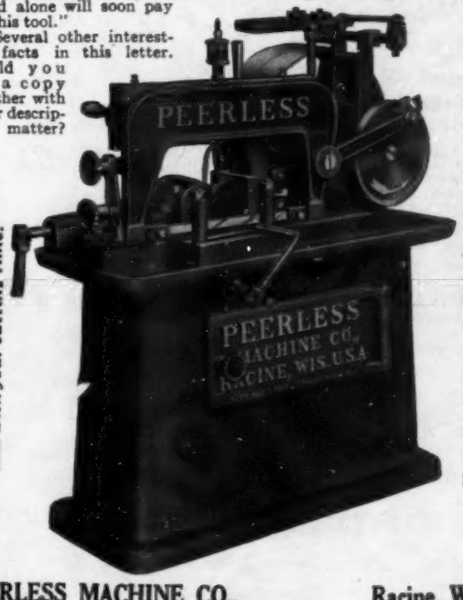
Are You Behind on Cutting Your Steel?

—then read these two paragraphs from a customer's letter. Could anyone expect to hear so favorably from a customer after waiting eight weeks for delivery on machine? It was real production and satisfaction that prompted them to write this letter.

"On arrival of this machine we were so far behind on cutting that we thought sure one or two more machines would be required for our work, but owing to the high speed and the rapid cutting of this machine it has caught up with our work in a short time. We are now more than pleased that we had the patience and waited delivery on this tool, even if we were put to considerable inconvenience, as a lot of our work had to be sent out to be cut.

"We must say that this tool is certainly a great time saver in actual time saved in operating the machine. We figure the operator's time saved alone will soon pay for this tool."

Several other interesting facts in this letter. Would you like a copy together with other descriptive matter?

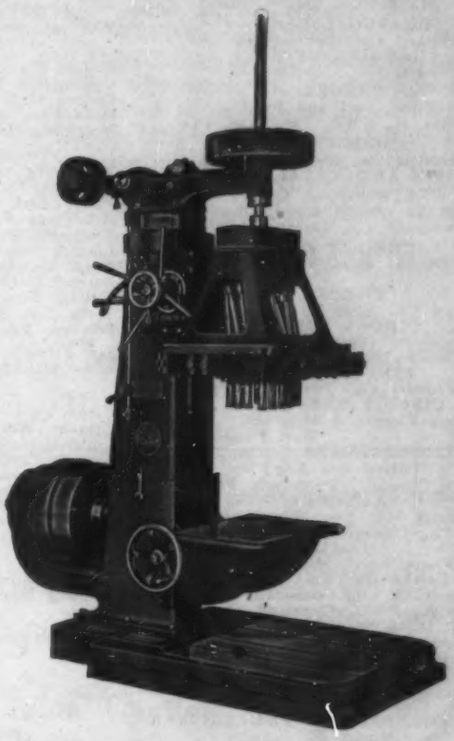


This machine cuts off 2¼" round Manganese bronze in 13 seconds. Compare this with your cutting time.

Note its rigid construction, it means increase in production.

PEERLESS MACHINE CO., **Racine, Wis.**
1605 Racine Street

BAUSH
Multiple Drills



FOR CRANK CASE AND GENERAL AUTOMOBILE DRILLING

Baush Machine Tool Co.

Makers of

Drilling Machinery

Wason Ave.
Springfield, Mass.
New York Office, 50 Church St.

CEMENT WATERPROOFING.
Texas Company, The, New York City.

CENTRAL STATION EQUIPMENT.
Crocker-Wheeler Co., Ampere, N. J.
General Electric Co., Schenectady, N. Y.
Smith Gas Engrg. Co., The, Lexington, O.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

CENTRIFUGAL COAL DRIERS.
Link-Belt Co., Chicago, Ill.

CHAIN DRIVES.
Link-Belt Co., Chicago, Ill.

CHAINS.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Link-Belt Co., Chicago, Ill.
Weimer Chain & Iron Co., Lebanon, Pa.

CHAINS.
(Conveyor.)
Link-Belt Co., Chicago, Ill.

CHAINS.
(Power Transmitting.)
Link-Belt Co., Chicago, Ill.

CHAPLETS.
Champion Mch. & Forging Co., Cleveland, O.

CHARCOAL.
Hillman, J. H., & Sons Co., Pittsburgh, Pa.

CHARCOAL CARS.
Lakewood Engrg. Co., Cleveland, O.

CHARGING BUGGY.
Lakewood Engrg. Co., Cleveland, O.

CHECKS.
(Time, Tool and Pay.)
Matthews, Jas. H., & Co., Pittsburgh, Pa.

CHEMICALS.
General Chemical Co., Cleveland, O.

CHEMISTS AND METALLURGISTS.
Bidle Co., W. S., Cleveland, O.
Hunt, Robt. W., Co., Chicago, Ill.
Steel Improvement Co., Cleveland, O.

CHROME ORE.
Blackwell, Geo. G., Sons & Co., Ltd., Liverpool, Eng.

CHUCKS.
Modern Tool Co., Erie, Pa.

CINDER MILLS.
(Water.)
Whiting Foundry Equip. Co., Pittsburgh, Pa.

CINDER POTS.
Marshall Foundry Co., Pittsburgh, Pa.

CIRCUIT BREAKERS.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

CLEATS.
(Barrel and Keg.)
Hubbard & Company, Pittsburgh, Pa.

CLUTCHES.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
Link-Belt Co., Chicago, Ill.

COAL.
Baird & West, Detroit, Mich.
Columbus Iron & Steel Co., Columbus, O.
Eaton, Rhodes & Co., Cincinnati, O.
Hanna, M. A., & Co., Cleveland, O.
Hillman, J. H., & Sons Co., Pittsburgh, Pa.
Rogers, Brown & Co., Chicago, Ill.
Semet-Solvay Co., Syracuse, N. Y.
Snyder, W. P., Co., Pittsburgh, Pa.
Tenn. Coal, Iron & R. R. Co., Birmingham, Ala.
Washington Coal & Coke Co., Dawson, Pa.

COAL CRUSHERS AND PULVERIZERS.
Link-Belt Co., Chicago, Ill.
Orton & Steinbrenner Co., Chicago, Ill.
Williams Patent Crusher & Pulverizer Co., Chicago, Ill.

COAL, ORE AND ASH HANDLING MACHINERY.
American Bridge Co., New York, N. Y.
Frazier & Sheal Co., Cleveland, O.
Link-Belt Co., Chicago, Ill.
Orton & Steinbrenner Co., Chicago, Ill.

COAL TIPPLES.
Eichleay, John, Jr., Co., Pittsburgh, Pa.

COAL WASHERS.
Link-Belt Co., Chicago, Ill.

COILS.
(Pipe.)
Pittsburgh Piping & Equip. Co., Pittsburgh.

COILS.
(Pipe, for Tanks and Tank Cars.)
Best Company, Pittsburgh, Pa.

COKE.
Baird & West, Detroit, Mich.
Bourne-Fuller Co., Cleveland, O.
Crocker Bros., New York City.
Eaton, Rhodes & Co., Cincinnati, O.
Hanna, M. A., & Co., Cleveland, O.
Hillman, J. H., & Sons Co., Pittsburgh, Pa.
McKeefrey & Co., Leetonia, O.
Mohr, J. J., & Son, Philadelphia, Pa.
Rogers, Brown & Co., Cincinnati, O.
Semet-Solvay Co., Syracuse, N. Y.
Snyder W. P. & Co., Pittsburgh, Pa.
Stewart Iron Co., Ltd., Cleveland, O.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.
Washington Coal & Coke Co., Dawson, Pa.

COKE OVENS.
(By-Product.)
Clarke, Thomas C., New York City.
Koppers, H., Co., Pittsburgh, Pa.

COMPRESSORS.
(Air.)
Bethlehem Steel Co., So. Bethlehem, Pa.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Norwalk Iron Works Co., So. Norwalk, Conn.

COMPRESSORS.
(Gas.)
Bethlehem Steel Co., Bethlehem, Pa.
Norwalk Iron Works Co., So. Norwalk, Conn.

CONCRETE CULVERT PIPE.
Concrete Products Co., Pittsburgh, Pa.

CONCRETE INSERTS.
Dayton Malleable Iron Co., Dayton, O.

CONCRETE MINE SHAFT LINING.
Concrete Products Co., Pittsburgh, Pa.

CONCRETE MIXERS.
Lakewood Engrg. Co., Lakewood, O.
Standard Scale & Supply Co., Pittsburgh, Pa.

CONCRETE ROAD GUARD FENCE.
Concrete Products Co., Pittsburgh, Pa.

CONCRETE SEWER PIPE.
Concrete Products Co., Pittsburgh, Pa.

CONCRETE CONSTRUCTION.
Westinghouse-Church-Kerr & Co., New York.

CONDENSERS.
Buffalo Fdy. & Machine Co., Buffalo, N. Y.
Connersville Blower Co., The, Connersville, Ind.
Cooper, C. & G., Co., Mt. Vernon, O.
Dean Bros. Steam Pump Works, Indianapolis.
Mesta Machine Co., Pittsburgh, Pa.

CONTRACT WORK.
Acme Mfg. Co., Boonton, N. J.
American Twist Drill Co., Laconia, N. H.
Farrel-Cheek Steel Fdy. Co., Sandusky, O.
Hill Pump Valve Co., Chicago, Ill.
Klotz Machine Co., Sandusky, O.
Lansing Stamping & Tool Co., Lansing, Mich.
Metal Specialty Co., Cincinnati, O.
Murcott-Duden Co., New York City.
Newark Stamping & Fdy. Co., Newark, N. J.
Scott, Geo. H., Mach. Co., Cleveland, O.
Scranton Pump Co., Scranton, Pa.

CONTRACTORS.
(See Engineers and Contractors.)

CONTROLLERS.
(Electric.)
Crocker, Wheeler Co., Ampere, N. J.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
Electric Controller & Mfg. Co., Cleveland, O.
General Electric Co., Schenectady, N. Y.
Toledo Bridge & Crane Co., Toledo, O.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

CONVERTERS.
(Steel Casting.)
Tropenas Converter Co., Brooklyn, N. Y.
Whiting Foundry Equipment Co., Harvey, Ill.

CONVEYORS.
Link-Belt Co., Chicago, Ill.

CONVEYORS.
(Ash.)
Roots, P. H., & F. M., Co., Connersville, Ind.

CONVEYORS.
(Elevating and Conveying.)
Brown Hoisting Machinery Co., Cleveland, O.
Link Belt Co., Chicago, Ill.
McMyler Interstate Co., Cleveland, O.
Vulcan Iron Works, Wilkesbarre, Pa.
Wellman-Seaver-Morgan Co., Cleveland, O.

CORE MAKING MACHINES.
Pridmore, Henry E., Chicago, Ill.

CORE OVENS.
Metals Production Equipment Co., Springfield, Mass.
Whiting Fdy. Equipment Co., Harvey, Ill.

CORE OVEN CARS.
Lakewood Engrg. Co., Cleveland, O.

COUNTING MACHINES.
Hart, R. A., Mfg. Co., Battle Creek, Mich.

COUPLINGS.
American Vanadium Co., The, Pittsburgh, Pa.
Connersville Blower Co., The, Connersville, Ind.
National Tube Co., Pittsburgh, Pa.
Roots, P. H., & F. M., Co., Connersville, Ind.

CRANES.
(Charging.)
Alliance Machine Co., Alliance, O.
Morgan Engineering Co., Alliance, O.
Niles-Bement-Pond Co., New York, N. Y.
Pawling & Harnischfeger Co., Milwaukee, Wis.

CRANES.
(Electric.)
Alliance Machine Co., Alliance, O.
Brown Hoisting Machinery Co., Cleveland, O.
Browning Co., The, Cleveland, O.
Detroit Hoist & Mach. Co., Detroit, Mich.
Euclid Crane & Hoist Co., Euclid, O.
Industrial Works, Bay City, Mich.
Link-Belt Co., Chicago, Ill.
McMyler Interstate Co., Cleveland, O.
Morgan Engineering Co., Alliance, O.
Niles-Bement-Pond Co., New York, N. Y.
Northern Engineering Works, Detroit, Mich.
Orton & Steinbrenner Co., Chicago, Ill.
Pawling & Harnischfeger Co., Milwaukee, Wis.
Ridgway, Craig & Son, Coatesville, Pa.
Shaw Electric Crane Co., New York, N. Y.
Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.
Toledo Bridge & Crane Co., Toledo, O.
Whiting Foundry Equipment Co., Harvey, Ill.

CRANES.
(Hand.)
Brown Hoisting Machinery Co., Cleveland, O.
Euclid Crane & Hoist Co., Euclid, O.
Link-Belt Co., Chicago, Ill.
Niles-Bement-Pond Co., New York, N. Y.
Northern Engineering Works, Detroit, Mich.
Pawling & Harnischfeger Co., Milwaukee, Wis.
Toledo Bridge & Crane Co., Toledo, O.
Whiting Foundry Equipment Co., Harvey, Ill.

CRANES.
(Hydraulic.)
Alliance Machine Co., Alliance, O.
Chambersburg Engrg. Co., Chambersburg, Pa.
Morgan Engineering Co., Alliance, O.
Ridgway, Craig, & Son, Coatesville, Pa.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

CRANES.
(Locomotive.)
Brown Hoisting Machinery Co., Cleveland, O.
Browning Co., The, Cleveland, O.
Industrial Works, Bay City, Mich.
Link-Belt Co., Chicago, Ill.
McMyler Interstate Co., Cleveland, O.
Niles-Bement-Pond Co., New York, N. Y.
Orton & Steinbrenner Co., Chicago, Ill.
Pawling & Harnischfeger Co., Milwaukee, Wis.
Wellman-Seaver-Morgan Co., Cleveland, O.

CRANES.
(Steam Cleaning House.)
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

CRANES.
(Steam and Pneumatic, Wire Mills.)
Detroit Hoist & Mach. Co., Detroit, Mich.
Morgan Construction Co., Worcester, Mass.

CRANK SHAFTS.
Bethlehem Steel Co., So. Bethlehem, Pa.
Kropp Forge Co., Chicago, Ill.
Norton Grinding Co., Worcester, Mass.

CRAYONS.
Weber-Erickson-Bunting Co., Pittsburgh, Pa.

CREDITS.
Iron & Steel Board of Trade, N. Y. City.

CRIB MEMBERS.
(Concrete.)
Concrete Products Co., Pittsburgh, Pa.

CRUCIBLES.
Dixon, Joseph, Crucible Co., Jersey City, N. J.

CRUSHING MACHINERY.
Chalmers & Williams, Chicago Heights, Ill.
Link-Belt Co., Chicago, Ill.
Vulcan Iron Works, Wilkesbarre, Pa.
Williams Patent Crusher & Pulverizer Co., Chicago, Ill.

CUPOLA.
Northern Engineering Works, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.

CUPOLA BLOCKS.
Mutton Hollow Fire Brick Co., The, Woodbridge, N. J.

CUPOLA, FURNACE AND FORGE LINING.
Louisville Fire Brick Wks., Highland Park, Ky.
Mutton Hollow Fire Brick Co., Woodbridge, N. J.

CUPOLA PRACTICE.
McLain's System, Milwaukee, Wis.

CUPRO-VANADIUM.
American Vanadium Co., Pittsburgh, Pa.

CUPS.
(Oil, Grease, Etc.)
National Malleable Casting Co., Cleveland, O.

CUTTERS.
(Keyway.)
Morton Mfg. Co., Muskegon Heights, Mich.

CUTTING AND WELDING APPARATUS.
(Electric.)
Linde Air Products Co., New York, N. Y.
Oxweld Acetylene Co., Chicago, Ill.
Toledo Electric Welder Co., Toledo, O.
Thompson Electric Welding Co., Lynn, Mass.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

CUTTING.
(Oxy-Acetylene Process.)
Oxweld Acetylene Co., Chicago, Ill.
Prest-O-Lite, The, Co., Indianapolis, Ind.

CUTTING OFF MACHINES.
Birdsboro Steel Fdy. & Mach. Co., Birdsboro, Pa.
Cleveland Punch & Shear Works Co., Cleveland, O.
Espen-Lucas Machine Works, Philadelphia, Pa.
Newton Mach. Tool Wks., Inc., Philadelphia.
Peerless Machine Co., Racine, Wis.
Southwark Fdy. & Mch. Co., Philadelphia, Pa.

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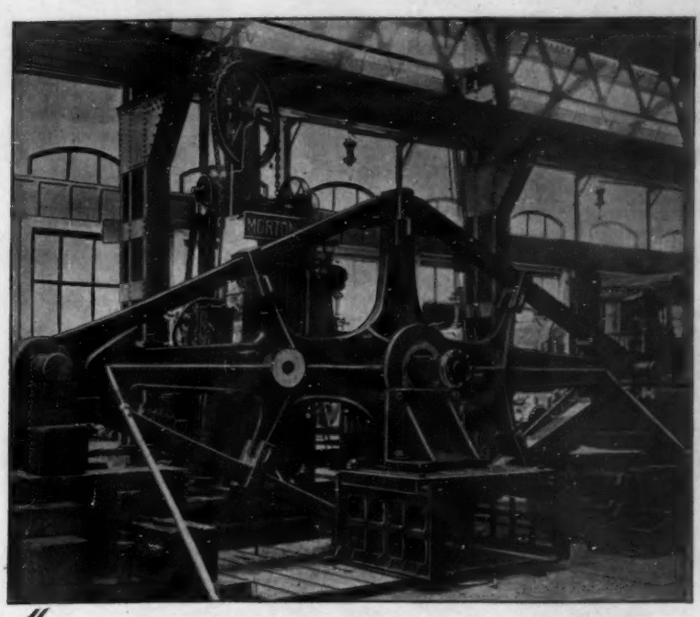

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Molding Methods in the Malleable Foundry.
Melting Processes.
The Construction and Operation of the Air Furnace.
Construction and Operation of the Open-Hearth Furnace.
The Use of Gas Producers in Malleable Foundries.
Mixing the Charges for Malleable Iron.
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Dake Engine Co., Grand Haven, Mich.

DIE PLATES AND WORLDS.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

DIES.
American Vanadium Co., The, Pittsburgh, Pa.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Buffalo Fdy. & Mach. Co., Buffalo, N. Y.
Jones & Lamson Mch. Co., Springfield, Mass.
Landis Machine Co., Waynesboro, Pa.
Lansing Stamping & Tool Co., Lansing, Mich.
Modern Tool Co., Erie, Pa.
Pannier Bros. Stamp Co., Pittsburgh, Pa.
Sivyer Steel Castings Co., Milwaukee, Wis.
Toledo Machine & Tool Co., Toledo, O.

DIES.
(Lettering and Embossing.)
Matthews, Jas. H., & Co., Pittsburgh, Pa.

DOCKS.
Frazier & Sheal Co., Cleveland, O.

DOLOMITE.
(Dead Burned.)
Davison, Allen S., Company, Pittsburgh, Pa.

DOORS.
(Steel.)
Trussed Concrete Steel Co., Detroit, Mich.

DRAWING TABLES.
Economy Drawing Table Co., Toledo, O.

DRILLING MACHINES.
Allen, John F., Co., New York, N. Y.
Baker Bros., Toledo, O.
Baush Machine Tool Co., Springfield, Mass.
Cleveland Pneumatic Tool Co., Cleveland, O.
National Machinery Co., The, Tiffin, O.
Newton Mach. Tool Wks., Inc., Philadelphia.
Niles-Bement-Pond Co., New York, N. Y.

DRILLING MACHINES.
(Electric Portable.)
Van Dorn & Dutton Co., Cleveland, O.
Van Dorn Electric Tool Co., Cleveland, O.

DRILLING MACHINES.
(Pneumatic.)
Allen, John F., Co., New York City.
Cleveland Pneumatic Tool Co., Cleveland, O.

DRILLS.
American Vanadium Co., The, Pittsburgh, Pa.
Baush Machine Tool Co., Springfield, Mass.
McKenna Brothers, Pittsburgh, Pa.
Newton Mach. Tool Works, Inc., Philadelphia, Pa.
Ryerson, Jos. T., & Son, Chicago, Ill.

DRYERS.
(Ore.)
American Process Co., New York City.

DUST ARRESTING SYSTEM.
Whiting Foundry Equipment Co., Harvey, Ill.

ELECETRICAL INSTRUMENTS.
(Repaired and Tested.)
Stupakoff Laboratories, Pittsburgh, Pa.

ELECTRICAL WIRES AND CABLES.
Roebling's, John A., Sons Co., Trenton, N. J.

ELECTRIC EQUIPMENT.
Electric Controller & Mfg. Co., Cleveland, O.

ELECTRIC LIGHT EQUIPMENT.
Crocker Wheeler Co., Ampere, N. J.
Smith Gas Engrg. Co., The, Lexington, O.

ELEVATORS.
Link-Belt Co., Chicago, Ill.
Ridgway & Son, Craig, Coatesville, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

ENGINEERS AND CONTRACTORS.
Abramsen Engineering Co., Pittsburgh, Pa.
Alliance Structural Co., Alliance, O.
American Bridge Co., New York, N. Y.
Blair Engineering Co., Chicago, Ill.
Blaw Steel Construction Co., Hoboken, Pa.
Eichleay, John Jr., Co., Pittsburgh, Pa.
Frazier & Sheal Co., Cleveland, O.
Herrick, James A., New York City.
Hunt, Robert W., & Co., Chicago, Ill.
Kratzer, W. N., & Co., Pittsburgh, Pa.
Laughlin, Alex., & Co., Pittsburgh, Pa.
McClintic-Marshall Co., Pittsburgh, Pa.
McClure, Geo. W., Son & Co., Pittsburgh, Pa.
McKee, Arthur G., & Co., Cleveland, O.
Mesta Machine Co., Pittsburgh, Pa.
Morgan Engineering Co., Alliance, O.
Pittsburgh Pip'g & Equipment Co., Pittsburgh.
Rinehart, J. W., Cleveland, O.
Smythe, S. R., The, Co., Pittsburgh, Pa.
Swindell, Wm., & Bros., Pittsburgh, Pa.
Tod, Wm., Co., Youngstown, O.
Treadwell Engineering Co., Easton, Pa.
United Engrg & Fdy. Co., Pittsburgh, Pa.
Wellman-Seaver-Morgan Co., Cleveland, O.
Westinghouse-Church-Kerr & Co., New York.

ENGINEERS.
(Consulting.)
Clarke, Thomas C., New York City.
Duff, Samuel E., Pittsburgh, Pa.
Frazier & Sheal Co., Cleveland, O.
Moore, Frederick C., Cleveland, O.
Westinghouse-Church-Kerr & Co., New York.

ENGINEERS.
(Foundry, Mechanical and Electrical.)
Standard Sand & Mch. Co., Cleveland, O.

ENGINES.
(Fully Enclosed and Self-Oiling.)
Wachs, E. H., Company, Chicago, Ill.

ENGINES.
(Gas, Gasoline and Oil.)
Cooper, C. & G., Co., Mt. Vernon, O.
Mesta Machine Co., Pittsburgh, Pa.
Tod, Wm., Co., Youngstown, O.

ENGINES.
(Hoisting.)
Dake Engine Co., Grand Haven, Mich.
Vulcan Iron Works, Wilkesbarre, Pa.

ENGINES.
(Steam.)
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Cooper, C. & G., Co., Mt. Vernon, O.
Dake Engine Co., Grand Haven, Mich.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Phoenix Iron Works Co., Meadville, Pa.
Tod, Wm., Co., Youngstown, O.
Vulcan Iron Works, Wilkesbarre, Pa.
Wachs, E. H., Company, Chicago, Ill.

ENGINES.
(Stoker.)
Wachs, E. H., Company, Chicago, Ill.

ENGINES.
(Vertical.)
Wachs, E. H., Company, Chicago, Ill.

ENGRAVERS.
(Steel and Copper Plate.)
Wiggins, John B., Co., Chicago, Ill.

ENGRAVERS.
(Steel Die and Stamps.)
Matthews, Jas. H., & Co., Pittsburgh, Pa.

EXHAUSTERS.
(Gas.)
Connersville Blower Co., The, Connersville, Ind.
Roots Co., P. H. & F. M., Connersville, Ind.

EXPANDED METAL LATHE.
Youngstown Iron & Steel Co., Youngstown, O.

EYEBARS.
American Bridge Co., New York, N. Y.

FACINGS.
(Foundry.)
Dixon, Jos., Crucible Co., Jersey City, N. J.

FENCING.
Cambria Steel Co., Philadelphia, Pa.
Youngstown Sh't & Tube Co., Youngstown, O.

FERRO-ALLOYS.
Davison, Allen S., Co., Pittsburgh, Pa.

FERRO-CARBON TITANIUM.
Titanium Alloy Mfg. Co., Niagara Falls, N. Y.

FERRO-MANGANESE.
Blackwell, Geo. G., & Sons, Ltd., Liverpool, England.
Crocker Bros., New York City.
Edgertyn & Company, Inc., New York City.
Mohr, J. J., & Son, Philadelphia, Pa.
Rogers, Brown & Co., Cincinnati, O.
Samuel, Frank, Philadelphia, Pa.

FERRO-SILICON.
Blackwell, Geo. G., & Sons, Ltd., Liverpool, England.
Crocker Bros., New York City.
Davison, Allen S., Company, Pittsburgh, Pa.
Mohr, J. J., & Son, Philadelphia, Pa.
Rogers, Brown & Co., Cincinnati, O.
Samuel, Frank, Philadelphia, Pa.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.

FERRO TUNGSTEN.
Vanadium Alloys Steel Co., Pittsburgh, Pa.

FERRO-VANADIUM.
American Vanadium Co., Pittsburgh, Pa.

FILES.
Barnett, G. & H., Co., Philadelphia, Pa.
Disston, Henry, & Sons, Inc., Philadelphia, Pa.
Nicholson File Co., Providence, R. I.
Simonds Mfg. Co., Fitchburg, Mass.

FIRE BRICK AND CLAY.
Blackwell, Geo. G., Sons & Co., Ltd., Liverpool, England.
Clearfield Fire Brick Co., Clearfield, Pa.
Dover Fire Brick Co., Cleveland, O.
Eureka Fire Brick Works, Mt. Braddock, Pa.
Harbison-Walker Refractories Co., Pittsburgh.
Kier Fire Brick Co., Pittsburgh, Pa.
Louisville Fire Brick Co., Highland Park, Ky.
Mutton Hollow Fire Brick Co., The, Woodbridge, N. J.
Queens Run Fire Brick Co., Lock Haven, Pa.
Portsmouth Refractories Co., Portsmouth, O.
Soisson, Jos., Fire Brick Co., Connellsville, Pa.
Union Mining Co., Mt. Savage, Md.

FIRE CLAY.
(Ground.)
Union Mining Co., Mt. Savage, Md.

FLANGES.
(Pipe.)
Dart, E. M., Mfg. Co., Providence, R. I.
National Tube Co., Pittsburgh, Pa.
Pittsburgh Piping & Equip. Co., Pittsburgh.

FLAT WIRE—HIGH AND LOW CARBON.
Roebling's, John A., Sons Co., Trenton, N. J.

FLUEHOLES.
Worth Brothers Co., Philadelphia, Pa.

FLUOR-SPAR.
Rogers, Brown & Co., Cincinnati, O.

FLUX (for Iron and Brass.)
Basic Mineral Co., N. S., Pittsburgh, Pa.

FLY WHEELS.
Mesta Machine Co., Pittsburgh, Pa.
Tod, Wm., Co., Youngstown, O.

FORGES.
(Hard and Soft Coal and Coke.)
Bradley, C. C., & Son, Inc., Syracuse, N. Y.

FORGING MACHINERY.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Bliss, E. W., Co., Brooklyn, N. Y.
Caldwell, E. R., & Company, Bradford, Pa.
Erie Foundry Co., The, Erie, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Tod, Wm., Co., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

FORGINGS.
American Bridge Co., New York, N. Y.
American Iron & Steel Mfg. Co., Lebanon, Pa.
American Rolling Mill Co., Middletown, O.
American Vanadium Co., The, Pittsburgh, Pa.
Bay City Forge Co., Erie, Pa.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Bradley, C. C., & Son, Inc., Syracuse, N. Y.
Carnegie Steel Co., Pittsburgh, Pa.
Champion Mch. & Forging Co., Cleveland, O.
Columbus Forge & Iron Co., Columbus, O.
Drop Forging Co. of N. Y., Jersey City, N. J.
Eccles, Richard Co., Auburn, N. Y.
Ingalls-Shepard Forging Co., Chicago, Ill.
Kropp Forge Co., Chicago, Ill.
Leard, Wm. E., New Brighton, Pa.
Oliver Iron & Steel Co., Pittsburgh, Pa.
Otis Steel Co., Cleveland, O.
Rockford Drop Forge Co., Rockford, Ill.

FORGINGS.
(Bronze and Copper.)
American Manganese Bronze Co., Holmesburg, Philadelphia, Pa.
Kropp Forge Co., Chicago Ill.

FORGINGS.
(Drop.)
Champion Mch. & Forging Co., Cleveland, O.
Columbus Forge & Iron Co., Columbus, O.
Drop Forging Co. of N. Y., Jersey City, N. J.
Eccles, Richard, Co., Auburn, N. Y.
Endicott Forging & Mfg. Co., Endicott, N. Y.
General Drop Forge Co., Buffalo, N. Y.
Oliver Iron & Steel Co., Pittsburgh, Pa.
Ingalls-Shepard Forging Co., Chicago, Ill.
Kropp Forge Co., Chicago, Ill.
Rockford Drop Forge Co., Rockford, Ill.

FOUNDRY EQUIPMENT AND SUPPLIES.
Arcade Mfg. Co., Freeport, Ill.
Beals & Company, Buffalo, N. Y.
Lakewood Engrg. Co., Cleveland, O.
Oldham, Geo., & Sons, Co., Frankford, Philadelphia, Pa.
Pridmore, Henry E., Chicago, Ill.
Standard Sand & Machine Co., Cleveland, O.
Whiting Foundry Equipment Co., Harvey, Ill.

FRAMES.
(Rod, Wire, Galvanizing and Tinning.)
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

FUEL OIL.
Texas Company, The, New York City.

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Worth Brothers Co., Philadelphia, Pa.

FURNACE INSULATION.
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Gilbert & Barker Mfg. Co., Springfield, Mass.
Hagan, Geo. J., Pittsburgh, Pa.
Metals Production Equipment Co., Springfield, Mass.
Morgan Construction Co., Worcester, Mass.
Rockwell, W. S., Company, New York City.
Swindell & Bros., Wm., Pittsburgh, Pa.
Whiting Fdy. Equipment Co., Harvey, Ill.

FURNACES.
(Blast.)
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
McClure, Son & Co., G. W., Pittsburgh, Pa.
McKee, Arthur G., & Co., Cleveland, O.
Mt. Vernon Bridge Co., Mt. Vernon, O.
Riter-Conley Mfg. Co., Pittsburgh, Pa.
Tod, Wm., Co., Youngstown, O.
Wellman-Seaver-Morgan Co., Cleveland, O.

FURNACES.
(Crucible.)
Gilbert & Barker Mfg. Co., Springfield, Mass.
Laughlin, Alex., & Co., Pittsburgh, Pa.
Whiting Fdy. Equipment Co., Harvey, Ill.

FURNACES.
(Die Annealing.)
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

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AKRON, OHIO

FURNACES.
(Lead, Pot and Muffle Annealing, Wire Mills.)
Morgan Construction Co., Worcester, Mass.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

FURNACES.
(Open Hearth.)
Blair Engineering Co., Chicago, Ill.
Herrick, Jas. A., New York City.
Smythe, S. R., Co., Pittsburgh, Pa.
Snyder, W. P., & Co., Pittsburgh, Pa.
Tod-Stambaugh Co., Cleveland, O.
Whiting Foundry Equipment Co., Harvey, Ill.

FURNACES.
(Shrapnel.)
Gilbert & Barker Mfg. Co., Springfield, Mass.
Railway Materials Co., Chicago, Ill.
Rockwell, W. S., Co., New York City.

FURNACES.
(Tinning.)
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

FURNACES.
(Spelter.)
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

GALVANIZING EQUIPMENT.
American Bridge Co., New York.
Erie Foundry Co., Erie, Pa.

GAS BOOSTERS.
(Rotary Positive Pressure.)
Connersville Blower Co., The, Connersville, Ind.
Roots, P. H. & F. M., Co., Connersville, Ind.

GAS EXHAUSTERS.
Roots, P. H. & F. M., Co., Connersville, Ind.

GAS PRODUCERS.
Chapman Engineering Co., Mt. Vernon, O.
Hagan, Geo. J., Co., Pittsburgh, Pa.
Koppers, H., Co., Pittsburgh, Pa.
Morgan Const. Co., Worcester, Mass.
Smith Gas Engrg. Co., The, Lexington, O.
Wellman-Seaver-Morgan Co., Cleveland, O.

GAS RECOVERY COKE OVENS.
Koppers, H., Co., Pittsburgh, Pa.

GASKETS.
(Leather.)
Graton & Knight Mfg. Co., The, Worcester, Mass.
Williams, I. B., & Sons, Dover, N. H.

GEAR CASES.
Nat'l Malleable Castings Co., Cleveland, O.

GEAR CUTTING MACHINERY.
Bilgram Machine Works, Philadelphia, Pa.
Newton Mch. Tool Wks.. Inc., Philadelphia.

GEARS AND GEAR CUTTING.
(Iron and Steel.)
American Steel Foundries, Chicago, Ill.
American Vanadium Co., The, Pittsburgh, Pa.
Bilgram Machine Works, Philadelphia, Pa.
Dake Engine Co., Grand Haven, Mich.
Farrell Foundry & Machine Co., Ansonia, Ct.
Fawcus Machine Co., Pittsburgh, Pa.
General Electric Co., Schenectady, N. Y.
Horsburgh & Scott, Cleveland, O.
Hubbard Steel Fdy. Co., E. Chicago, Ind.
Link-Belt Co., Chicago, Ill.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Mesta Machine Co., The, Pittsburgh, Pa.
Morgan Construction Co., Worcester, Mass.
New Process Gear Corpn., Syracuse, N. Y.
Newton Mch. Tool Works, Inc., Philadelphia.
Ross-Meehan Foundries, Chattanooga, Tenn.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.
Taylor-Wilson Mfg. Co., McKees Rocks, Pa.
Tod, William, Co., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Van Dorn & Dutton Co., Cleveland, O.

GEARS.
(Rawhide.)
Chicago Rawhide Mfg. Co., Chicago, Ill.
Horsburgh & Scott Co., Cleveland, O.
New Process Gear Corpn., Syracuse, N. Y.
Nuttall, R. D., Co., Pittsburgh, Pa.
Van Dorn & Dutton Co., Cleveland, O.

GENERATORS.
(Direct and Alternating Current.)
Crocker-Wheeler Co., Ampere, N. J.
General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

GENERATORS.
(Hydrogen—Oxygen.)
International Oxygen Co., New York, N. Y.

GLASS.
(Wire.)
Trussed Concrete Steel Co., Detroit, Mich.

GRAB BUCKETS.
American Bridge Co., New York, N. Y.
Brown Hoisting Machy. Co., Cleveland, O.
Industrial Works, Bay City, Mich.
Lakewood Engrg. Co., Cleveland, O.
Link-Belt Co., Chicago, Ill.
McMyler Interstate Co., Cleveland, O.
Orton & Steinbrenner Co., Chicago, Ill.
Pawling & Harnischfeger Co., Milwaukee, Wis.

GRAPHITE.
Dixon, Jos., Crucible Co., Jersey City, N. J.

GRATE BARS.
Green Engrg. Co., Chicago, Ill.

GREASES.
Texas Company, The, New York City.

GRINDERS.
(Electric Portable.)
Van Dorn Electric Tool Co., Cleveland, O.

GRINDERS.
(Knife and Surface, Nail Mills.)
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

GRINDERS.
(Ore.)
Chalmers & Williams, Chicago Heights, Ill.

GRINDERS.
(Pneumatic.)
Cleveland Pneumatic Tool Co., Cleveland, O.

GRINDING MACHINES.
(Cylindrical.)
Modern Tool Co., Erie, Pa.
Norton Grinding Co., Worcester, Mass.

GRINDING MACHINES.
(Crank Shaft.)
Modern Tool Co., Erie, Pa.

GRINDING MACHINES.
(Die.)
Modern Tool Co., Erie, Pa.

GRINDING MACHINES.
(Motor Driven.)
Blake & Johnson Co., Waterbury, Conn.
Cincinnati Electrical Tool Co., Cincinnati, O.
Newton Mch. Tool Works, Inc., Philadelphia.
Norton Grinding Co., Worcester, Mass.

GRINDING PANS.
Phillips & McLaren Co., Pittsburgh, Pa.

GRINDING WHEEL STANDS.
Norton Grinding Co., Worcester, Mass.

HAMMERS.
(Drop.)
Alliance Machine Co., Alliance, O.
Bliss, E. W., Co., Brooklyn, N. Y.
Buffalo Fdy. & Machine Co., Buffalo, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Niles-Bement-Pond Co., New York, N. Y.
Ryerson, Joseph T., & Son, Chicago, Ill.
Toledo Machine & Tool Co., Toledo, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

HAMMERS.
(Power.)
Beaudry & Co., Inc., Boston, Mass.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Bradley, C. C., & Son, Inc., Syracuse, N. Y.
Buffalo Fdy. & Machine Co., Buffalo, N. Y.
Caldwell, E. K., & Co., Bradford, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cleveland Pneumatic Tool Co., Cleveland, O.
Cleveland Punch & Shear Works Co., Cleveland, O.
Erie Foundry Co., Erie, Pa.
Niles-Bement-Pond Co., New York, N. Y.
Toledo Machine & Tool Co., Toledo, O.

HAMMERS.
(Rawhide.)
Chicago Rawhide Mfg. Co., Chicago, Ill.

HARDWARE WAGONS.
Oliver Iron & Steel Co., Pittsburgh, Pa.

HEADERS.
(Welded.)
Best Company, Pittsburgh, Pa.

HEAT TREATING.
Bidle, W. S., Co., Cleveland, O.
Steel Improvement Co., Cleveland, O.

HOISTING MACHINERY.
Alliance Machine Co., Alliance, O.
Browning Co., The, Cleveland, O.
Chisholm & Moore Mfg. Co., Cleveland, O.
Dake Engine Co., Grand Haven, Mich.
Detroit Hoist & Mach. Co., Detroit, Mich.
Euclid Crane & Hoist Co., Euclid, O.
Hendrick Mfg. Co., Carbondale, Pa.
Illinois Malleable Iron Co., Chicago, Ill.
Link-Belt Co., Chicago, Ill.
Morgan Engineering Co., Alliance, O.
Niles-Bement-Pond Co., New York, N. Y.
Northern Engineering Works, Detroit, Mich.
Pawling & Harnischfeger Co., Milwaukee, Wis.
Ridgway & Son, Craig, Coatesville, Pa.
Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.
Toledo Bridge & Crane Co., Toledo, O.
Wellman-Seaver-Morgan Co., Cleveland, O.
Whiting Foundry Equipment Co., Harvey, Ill.

HOOPS AND BANDS.
Bourne-Fuller Co., The, Cleveland, O.
Carnegie Steel Co., Pittsburgh, Pa.
Illinois Steel Co., Chicago, Ill.
Ryerson, Joseph T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.

HOSE.
(Pneumatic.)
Cleveland Pneumatic Tool Co., Cleveland, O.
Oldham, Geo., & Son Co., Frankford, Philadelphia, Pa.

HOTELS.
Hotel Statler, Buffalo, Cleveland, Detroit.

HYDRAULIC MACHINERY.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Mesta Machine Co., Pittsburgh, Pa.
Southwark Fdy. & Mch. Co., Philadelphia, Pa.
Tod, Wm., Co., Youngstown, O.
Treadwell Engineering Co., Easton, Pa.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Watson-Stillman Co., New York, N. Y.

HYDRAULIC PRESSES.
Southwark Fdy. & Mch. Co., Philadelphia, Pa.

HYDROGEN.
International Oxygen Co., New York, N. Y.

INGOTS.
(Electric Furnace Steel.)
Latrobe Electric Steel Co., Latrobe, Pa.
Racine Steel Castings Co., Racine, Wis.

INGOTS.
(Steel.)
Cambria Steel Co., Philadelphia, Pa.
Pennsylvania Products Co., Pine Forge, Pa.

INGOT CARS.
Lakewood Engrg. Co., Cleveland, O.

INGOT MOLDS.
Marshall Foundry Co., Pittsburgh, Pa.

INSTRUMENTS.
(Electric Indicating and Recording.)
Brown Instrument Co., Philadelphia, Pa.
General Electric Co., Schenectady, N. Y.
Smith Gas Engrg. Co., The, Lexington, O

INSULATED WIRES AND CABLES
Roebling's, John A., Sons Co., Trenton, N. J.

INSULATING BRICK.
Armstrong Cork & Insulation Co., Pittsburgh.
Kieselguhr Co. of America, New York City.

INSULATION.
(Furnaces, Boiler Settings, Oven, Steam Pipe etc.)
Armstrong Cork & Insulation Co., Pittsburgh.
Kieselguhr Co. of America, New York City.

IRON.
(Basic—Bessemer—Malleable.)
Inland Steel Co., Chicago, Ill.

IRON.
(Ornamental.)
Belmont Iron Works, Philadelphia, Pa.

IRON AND STEEL.
American Vanadium Co., The, Pittsburgh, Pa.
Beals & Co., Buffalo, N. Y.
Bourne-Fuller Co., The, Cleveland, O.
Scully Steel & Iron Co., Chicago, Ill.
Westerman & Co., Lockport, N. Y.

IRON AND STEEL.
(Galvanized.)
Bourne-Fuller Co., The, Cleveland, O.
McCalla, Harold, Philadelphia, Pa.
Newport Rolling Mill Co., Newport, Ky.
Ryerson, Jos. T., & Son, Chicago, Ill.
Whitaker-Glessner Co., Portsmouth Wks., Portsmouth, O.
Youngstown Sheet & Tube Co., Youngstown, O.

IRON AND STEEL.
(Scrap.)
American Bridge Co., New York, N. Y.
U. S. Metal & Mfg. Co., New York City.

IRON ORE.
Blackwell, Geo. G., Sons & Co., Ltd., Liverpool, England.
Breitung, E. N., & Co., Cleveland, O.
Hanna, M. A., & Co., Cleveland, O.
Hillman, J. H., & Sons Co., Pittsburgh, Pa.
La Belle Iron Works, Steubenville, O.
Oglebay, Norton & Co., Cleveland, O.
Pennsylvania Products Co., Pine Forge, Pa.
Pickands, Mather & Co., Cleveland, O.
Snyder, W. P., & Co., Pittsburgh, Pa.
Tod-Stambaugh Co., Cleveland, O.

JACKS.
(Hydraulic.)
Southwark Fdy. & Mch. Co., Philadelphia, Pa.
Watson-Stillman Co., New York, N. Y.

JOLT RAMMING MACHINES.
Pridmore, Henry E., Chicago, Ill.

KEYS AND COTTERS.
(Machine.)
Leard, Wm. E., New Brighton, Pa.
Moltrup Steel Products Co., Beaver Falls, Pa.
Morton Mfg. Co., Muskegon Heights, Mich.
Standard Gauge Steel Co., Beaver Falls, Pa.

KEYSEATERS.
Baker Bros., Toledo, O.
Mitts & Merrill, Saginaw, Mich.

LABORATORIES.
Hunt, Robert W., & Co., Chicago, Ill.

LADLE BOWLS.
(Steel.)
Byram Company, Detroit, Mich.

LADLES.
Whiting Foundry Equipment Co., Harvey, Ill.

LAMPS.
(Arc and Incandescent.)
General Electric Co., Schenectady, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

LATH.
(Expanded Metal.)
Trussed Concrete Steel Co., Detroit, Mich.
Youngstown Iron & Steel Co., Youngstown, O.

See Index to Advertisements for Pages Containing Advertisements of Companies Listed Above

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LATHES.
Cincinnati Iron & Steel Co., Cincinnati, O.
Jones & Lamson Mach. Co., Springfield, Vt.
Manning, Maxwell & Moore, Inc., New York, N. Y.
Mesta Machine Co., Pittsburgh, Pa.
Morgan Construction Co., Worcester, Mass.
New Britain Mach. Co., New Britain, Conn.
Niles-Bement-Pond Co., New York, N. Y.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Youngstown Fdy. & Mach. Co., Youngstown, O.

LATHES.
(Die Reaming.)
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

LEATHER.
(Hydraulic.)
Graton & Knight Mfg. Co., Worcester, Mass.
Williams, I. B., & Sons, Dover, N. H.

LEATHER BELTING.
(See Belting Leather.)

LETTERS AND FIGURES.
(Steel, Hand Made.)
Matthews, Jas. H., & Co., Pittsburgh, Pa.

LETTERHEADS.
(Engraved.)
Wiggins, John B., Co., Chicago, Ill.

LIFTING MAGNETS.
Cutler Hammer Mfg. Co., Milwaukee, Wis.
Electric Controller & Mfg. Co., Cleveland, O.

LIMESTONE.
(Agricultural.)
Davison, Allen S., Co., Pittsburgh, Pa.

LIMESTONE.
(Crushed.)
Davison, Allen S., Co., Pittsburgh, Pa.

LINERS.
(Steel Keg.)
Hubbard & Company, Pittsburgh, Pa.

LININGS.
(Cupola, Furnace and Forge.)
Harbison-Walker Refractories Co., Pittsburgh.

LINK BELTING.
Link-Belt Co., Chicago, Ill.

LOCOMOTIVES.
Atlas Car & Mfg. Co., Cleveland, O.
General Electric Co., Schenectady, N. Y.
Vulcan Iron Works, Wilkesbarre, Pa.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

LOCOMOTIVES.
(Electric.)
Baldwin Locomotive Works, Philadelphia, Pa.

LUBRICANTS.
Dixon, Jos., Crucible Co., Jersey City, N. J.
Texas Company, The, New York City.

LUMBER.
(Boxing, Crating, Flask, Pattern and Templet.)
Johnson Lumber Co., Milwaukee, Wis.

MACHINE COUNTERS.
Hart, R. A., Mfg. Co., Battle Creek, Mich.

MACHINE KEYS.
(See Keys and Cotters, Machine.)

MACHINE WORK.
American Twist Drill Co., Laconia, N. H.
Hill Pump Valve Co., Chicago, Ill.
Klotz Machine Co., Sandusky, O.

MACHINERY.
(See Second Hand Machinery.)

MACHINISTS.
Adamson Machine Co., Akron, O.
Bethlehem Steel Co., South Bethlehem, Pa.
Blake & Johnson Co., Waterbury, Conn.
Bliss, E. W., Brooklyn, N. Y.
Buffalo Fdy. & Mach. Co., Buffalo, N. Y.
Dake Engine Co., Grand Haven, Mich.
Erie Foundry Co., Erie, Pa.
Fawcus Machine Co., Pittsburgh, Pa.
Hilles & Jones, Wilmington, Del.
Manning, Maxwell & Moore, Inc., New York, N. Y.
Mesta Machine Co., Pittsburgh, Pa.
Morgan Engrg. Co., Alliance, O.
Tod, Wm., Co., Youngstown, O.
Toledo Mach. & Tool Co., Toledo, O.
Torrington Mfg. Co., Torrington, Conn.

MAGNESITE.
American Refractories Co., Chicago, Ill.
Edgertyn & Company, Inc., New York City.

MAGNESITE.
(Calcined.)
Davison, Allen S., Co., Pittsburgh, Pa.

MANHOLES.
Worth Brothers Co., Philadelphia, Pa.

MASON CONTRACTORS.
(Blast Furnace Works.)
Rinehart, J. W., Cleveland, O.

MERCANTILE AGENCIES.
Iron & Steel Board of Trade, New York City.

METALS.
(Non-Ferrous.)
American Manganese Bronze Co., Holmesburg, Philadelphia, Pa.
Blackwell, Geo. G., Sons & Co., Liverpool, Eng.
Lubricating Metal Co., The, New York City.
Titanium Alloy Mfg. Co., Niagara Falls, N. Y.

METAL SPECIALTIES.
White, L. & I. J., Co., Buffalo, N. Y.

METALLURGISTS.
Steel Improvement Co., Cleveland, O.

METALLURGY OF IRON.
McLain's System, Milwaukee, Wis.

MILL AND MINE SUPPLIES.
Dake Engine Co., Grand Haven, Mich.

MILLING MACHINES.
Cincinnati Milling Mach Co., Cincinnati, O.
Espen-Lucas Machine Works, Philadelphia, Pa.
Newton Mch. Tool Wks., Inc., Philadelphia.
Niles-Bement-Pond Co., New York, N. Y.
Warner & Swasey Co., Cleveland, O.

MILLS.
(Blooming, Universal, Plate, Sheet, Tin, Bar.)
Bethlehem Steel Co., Bethlehem, Pa.
Mesta Machine Co., Pittsburgh, Pa.

MINE SHAFT LINING.
(Concrete.)
Concrete Products Company, Pittsburgh, Pa.

MINING MACHINERY.
Link-Belt Co., Chicago, Ill.
McMyler Interstate Co., Cleveland, O.

MIXERS.
(Concrete.)
Standard Scale & Supply Co., Pittsburgh, Pa.

MOLDING MACHINES.
Arcade Mfg. Co., Freeport, Ill.
Pridmore, Henry E., Chicago, Ill.

MONEL METAL.
Williams & Co., Pittsburgh, Pa.

MOTORS.
(Air.)
Dake Engine Co., Grand Haven, Mich.
Detroit Hoist & Machine Co., Detroit, Mich.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

MOTORS.
(Electric.)
Crocker-Wheeler Co., Ampere, N. J.
General Electric Co., Schenectady, N. Y.
Moore, Edgar M., & Co., Pittsburgh, Pa.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

MOTORS.
(Second Hand.)
Moore, Edgar M., & Co., Pittsburgh, Pa.

MOTOR TRUCKS.
Kissel Motor Car Co., Hartford, Wis.

NAIL MACHINERY.
Kilby Mfg. Co., Cleveland, O.
National Machinery Co., Tiffin, O.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

NAILS.
Cambria Steel Co., Philadelphia, Pa.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
La Belle Iron Works, Steubenville, O.
Youngstown Sheet & Tube Co., Youngstown, O.

NAME PLATES.
(Cast. Bronze, Stamped and Etched.)
Matthews, Jas. H., & Co., Pittsburgh, Pa.

NUTS.
(See Bolts and Nuts.)

OIL CANS.
New Britain Machine Co., New Britain, Conn.

OPEN HEARTH FURNACES.
(See Furnaces—Open Hearth.)

ORE.
(Chrome.)
Blackwell, Geo. G., Sons Co., Ltd., Liverpool, Eng.

ORE.
(Lead.)
Amer. Zinc, Lead & Smelt'g Co., New York.

ORE.
(Magnesite.)
Edgertyn & Company, Inc., New York City.

ORE.
(Zinc.)
Amer. Zinc, Lead & Smelt'g Co., New York.

ORE DOCKS.
American Bridge Co., New York, N. Y.

OVENS.
(Coke, By-Product Recovery.)
Koppers, H., Co., Pittsburgh, Pa.

OVENS.
(Wire Bluing.)
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

OXY-ACETYLENE WELDING AND CUTTING.
Oxweld Acetylene Co., Chicago, Ill.
Prest-O-Lite Co., The, Indianapolis, Ind.

OXYGEN.
International Oxygen Co., New York, N. Y.
Linde Air Products Co., New York, N. Y.

PACKING.
(Metallic.)
Lubricating Metal Co., The, New York, N. Y.

PACKINGS.
(Leather.)
Graton & Knight Mfg. Co., Worcester, Mass.
Williams, I. B., & Sons, Dover, N. H.

PAINT.
Dixon, Jos., Crucible Co., Jersey City, N. J.

PANS.
(Lathe and Shop.)
American Bridge Co., New York, N. Y.
New Britain Mach. Co., New Britain, Conn.

PATTERNS.
(Metal and Wood.)
Acme Steel & Mall. Iron Wks., Inc., Buffalo.
Arcade Mfg. Co., Freeport, Ill.
Buffalo Fdy & Mch. Co., Buffalo, N. Y.
Newark Stamping & Fdy. Co., Newark, N. J.
Pridmore, Henry E., Chicago, Ill.

PERFORATED METAL.
Erdle Perforating Co., Rochester, N. Y.
Hendrick Mfg. Co., Carbondale, Pa.

PIG IRON.
American Pig Iron Storage Warrant Co., New York City.
Baird & West, Detroit, Mich.
Bethlehem Steel Co., Bethlehem, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Columbus Iron & Steel Co., Columbus, O.
Crocker Bros., New York, N. Y.
Davison, Allen S., Co., Pittsburgh, Pa.
Domhoff & Joyce Co., The, Cincinnati, O.
Eaton, Rhodes Co., Cincinnati, O.
Globe Iron Co., Jackson, O.
Hanna, M. A., & Co., Cleveland, O.
Hillman & Sons Co., J. H., Pittsburgh, Pa.
Illinois Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
McKeefrey & Co., Leetonia, O.
Mitchell-Diggins Iron Co., Cadillac, Mich.
Mohr, J. J., & Son, Philadelphia, Pa.
Pickands, Mather & Co., Cleveland, O.
Reliance Iron & Coke Co., Cincinnati, O.
Republic Iron & Steel Co., Youngstown, O.
Rogers, Brown & Co., Cincinnati, O.
Semet-Solvay Co., Syracuse, N. Y.
Snyder, W. P., & Co., Pittsburgh, Pa.
Stewart Iron Co., Ltd., Cleveland, O.
Struthers Furnace Co., The, Cleveland, O.
Superior Charcoal Iron Co., Grand Rapids, Mich.
Tenn. Coal, Iron & R. R. Co., Birmingham, Ala.
Thomas Furnace Co., Milwaukee, Wis.
Upson Nut Co., Cleveland, O.
Wheeler, Charles Child, New York City.

PIG IRON BREAKERS.
Brown Hoisting Machinery Co., Cleveland, O.

PIG IRON WARRANTS.
American Pig Iron Storage Warrant Co., New York City.
Wheeler, Charles, Child, New York City.

PILE DRIVERS.
Industrial Works, Bay City, Mich.

PILING.
(Steel Sheet.)
Carnegie Steel Co., Pittsburgh, Pa.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Lackawanna Steel Co., Buffalo, N. Y.

PINIONS.
(See Gears.)

PINS.
American Vanadium Co., The, Pittsburgh, Pa.
Oliver Iron & Steel Co., Pittsburgh, Pa.

PIPE.
(Cast Iron.)
American Cast Iron Pipe Co., Birmingham, Ala.
Clow, James B., & Sons, Chicago, Ill.
Donaldson Iron Co., Emaus, Lehigh Co., Pa.
Glamorgan Pipe & Fdy. Co., Lynchburg, Va.
Lynchburg Fdy. Co., Lynchburg, Va.
Massillon Iron & Steel Co., Massillon, O.
Stand'd Cast Iron Pipe & Fdy. Co., Bristol, Pa.
U. S. Cast Iron Pipe & Fdy. Co., Philadelphia

PIPE.
(Concrete Sewer and Culvert.)
Concrete Products Co., Pittsburgh, Pa.

PIPE.
(Iron and Steel.)
American Bridge Co., New York, N. Y.
Best Company, Pittsburgh, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Buffalo Fdy. & Mach. Co., Buffalo, N. Y.
Byers, A. M., Co., Pittsburgh, Pa.
Central Tube Co., Pittsburgh, Pa.
La Belle Iron Works, Steubenville, O.
Pittsburgh Piping & Equip. Co., Pittsburgh.
Republic Iron & Steel Co., Youngstown, O.
Riter-Conley Mfg. Co., Pittsburgh, Pa.
U. S. Cast Iron Pipe & Fdy. Co., Burlington, N. J.
Youngstown Sheet & Tube Co., Youngstown, O

PIPE.
(Steel.)
National Tube Co., Pittsburgh, Pa.

PIPE.
(Wrought Iron.)
Bourne-Fuller Co., The, Cleveland, O.
Byers, A. M., Co., Pittsburgh, Pa.
Pittsburgh Piping & Equip. Co., Pittsburgh.
Youngstown Sheet & Tube Co., Youngstown, O.

PIPE COVERING.
(Steam and Cold Water.)
Armstrong Cork & Insulation Co., Pittsburgh.

PIPE FITTINGS.
Best Company, Pittsburgh, Pa.
Illinois Malleable Iron Co., Chicago, Ill.
National Tube Co., Pittsburgh, Pa.
Pittsburgh Piping & Equip. Co., Pittsburgh.
Southwark Fdy. & Mach. Co., Pittsburgh, Pa.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

PIPE MILL MACHINERY.
Landis Machine Co., Waynesboro, Pa.
Taylor-Wilson Mfg. Co., McKees Rocks, Pa.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Williams Tool Co., Erie, Pa.

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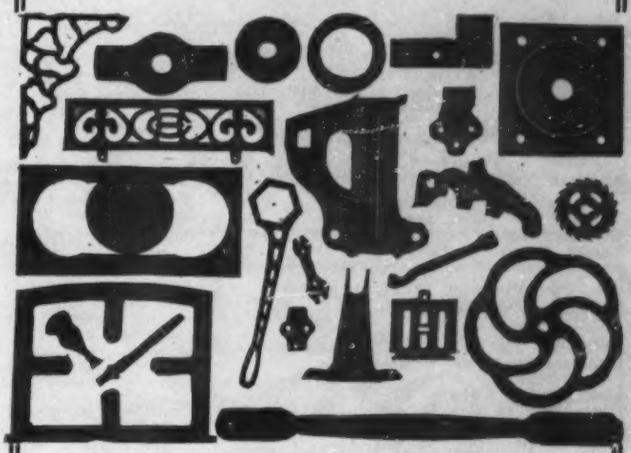
CASTINGS

Malleable Iron
and Steel Castings
The National Malleable Castings Co.

Cleveland Chicago Indianapolis Toledo
Sharon, Pa. Melrose Park, Ill.

QUALITY SERVICE
The WEST STEEL CASTING Co
SMALL STEEL CASTINGS
AUTOMOBILE CASTINGS
SAFETY LATHE DOGS
WSC SPECIAL DYNAMO STEEL FOR ELECTRIC CASTINGS Cleveland
CRUCIBLE CONVERTED

MALLEABLE IRON
CASTINGS
OF EVERY DESCRIPTION
Annual Capacity 25,000 Tons



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Prices furnished on receipt of Samples or Blue Prints
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EAST ST. LOUIS, ILL.

Malleable Iron Castings
Quality and Service
The Danville Malleable Iron Company
DANVILLE, ILLINOIS

Dayton Malleable Iron Co.
Dayton, Ohio

CASTINGS
FINE LIGHT GRAY IRON
North Buffalo Hardware Foundry
BUFFALO, N. Y.

ERIE MALLEABLE IRON COMPANY
ERIE, PA.

PIPE TAGS.
Matthews, Jas. H., & Co., Pittsburgh, Pa.
Weber-Erickson-Bunting Co., Pittsburgh, Pa.

PIPE THREADING MACHINERY.
Standard Engrg. Co., Ellwood City, Pa.
Treadwell Engineering Co., Easton, Pa.

PIPING CONTRACTORS.
Best Company, Pittsburgh, Pa.
Pittsburgh Piping & Equip. Co., Pittsburgh.

PLANERS.
Cincinnati Planer Co., Cincinnati.
Cleveland Punch & Shear Works Co., Cleveland, O.
Manning, Maxwell & Moore, Inc., New York, N. Y.
Morton Mfg. Co., Muskegon Heights, Mich.
Newton Mch. Tool Works, Inc., Philadelphia.
Niles-Bement-Pond Co., New York, N. Y.
Ryerson, Joe. E., & Son, Chicago, Ill.

PLATE CONSTRUCTION.
Worth Brothers Co., Philadelphia, Pa.

PLATES.
(Rolled Steel—Floor.)
Carnegie Steel Co., Pittsburgh, Pa.
Trussed Concrete Steel Co., Detroit, Mich.
Wood, Alan, Iron & Steel Co., Philadelphia.

PLATES.
(Terne and Tin.)
American Sheet & Tin Plate Co., Pittsburgh.

PLATES.
(Universal and Sheared.)
Allegheny Steel Co., Pittsburgh, Pa.
American Rolling Mill Co., Middletown, O.
Belmont Iron Works, Philadelphia, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Cambria Steel Co., Philadelphia, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Cincinnati Iron & Steel Co., Cincinnati, O.
Illinois Steel Co., Chicago, Ill.
Illinois Steel Co., Warehouse Dept., Chicago.
Illinois Steel Warehouse Co., St. Louis, Mo.
Illinois Steel Warehouse Co., St. Paul, Minn.
Inland Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
Lackawanna Steel Co., Buffalo, N. Y.
Otis Steel Co., Cleveland, O.
Pennsylvania Products Co., Pine Forge, Pa.
Republic Iron & Steel Co., Youngstown, O.
Tenn. Coal, Iron & R. R. Co., Birmingham, Ala.
Trussed Concrete Steel Co., Detroit, Mich.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Wood, Alan, Iron & Steel Co., Philadelphia.
Worth Bros. Co., Philadelphia, Pa.
Youngstown Sheet & Tube Co., Youngstown, O.

PLATES, STEEL.
(For Marine, Locomotives and Stationary Boilers.)
Worth Brothers Co., Philadelphia, Pa.

PLATES.
(Vanadium Steel.)
American Vanadium Co., The, Pittsburgh, Pa.

POINTERS.
(Wire and Rod.)
Morgan Construction Co., Worcester, Mass.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

POWDERED COAL PLANTS.
Metal Production Equipment Co., Springfield, Mass.

POWER TRANSMITTING MACHINERY.
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
Link-Belt Co., Chicago, Ill.
Mesta Machine Co., Pittsburgh, Pa.
Treadwell Engineering Co., Easton, Pa.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

PRESSES.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W., Co., Brooklyn, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cleveland Punch & Shear Works Co., Cleveland, O.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Morgan Engineering Co., Alliance, O.
Niles-Bement-Pond Co., New York, N. Y.
Ryerson, Jos. T., & Son, Chicago, Ill.
Tod, Wm., Co., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Wood, R. D., & Co., Philadelphia, Pa.

PRESSES.
(Bending and Flanging.)
Chambersburg Engrg. Co., Chambersbug, Pa.
Hydraulic Press Mfg. Co., Mount Gilead, O.
Mesta Machine Co., Pittsburgh, Pa.

PRESSES.
(Forging.)
Chambersburg Engrg. Co., Chambersburg, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Tod, Wm., Co., Youngstown, O.
Watson-Stillman Co., New York, N. Y.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

PRESSES.
(Hydraulic.)
Chambersburg Engrg. Co., Chambersburg, Pa.
Hydraulic Press Mfg. Co., Mount Gilead, O.
Mesta Machine Co., Pittsburgh, Pa.
Niles-Bement-Pond Co., New York, N. Y.
Southwark Fdy. & Mch. Co., Philadelphia, Pa.
Tod, Wm., Co., Youngstown, O.
Treadwell Engineering Co., Easton, Pa.
United Engrg & Fdy. Co., Pittsburgh, Pa.
Watson-Stillman Co., New York, N. Y.

PRESSES.
(Power.)
Toledo Machine & Tool Co., Toledo, O.

PRESSES.
(Rail Straightening.)
Tod, Wm., Co., Youngstown, O.

PRESSES.
(Toggle Drawing.)
Toledo Machine & Tool Co., Toledo, O.

PRESSES.
(Trimming.)
Erie Foundry Co., Erie, Pa.
Toledo Machine & Tool Co., Toledo, O.

PRESSURE GAGES.
Clark, Chas. J., Chicago, Ill.

PRESSURE REGULATORS.
Connersville Blower Co., The, Connersville, Ind.
Electric Controller & Mfg. Co., Cleveland, O.

PULVERIZING MILLS.
Williams Patent Crusher & Pulverizer Co., Chicago, Ill.

PUMPS.
Aldrich Pump Co., Allentown, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Connersville Blower Co., The, Connersville, Ind.
Dake Engine Co., Grand Haven, Mich.
Dean Bros. Steam Pump Works, Indianapolis, Ind.
Deming Co., Salem, O.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Hydraulic Press Mfg. Co., Mount Gilead, O.
Roots, P. H. & F. M., Co., Connersville, Ind.
Tod, Wm., Co., Youngstown, O.
Vulcan Iron Works, Wilkesbarre, Pa.

PUMPS.
(By-Products.)
Dean Bros. Steam Pump Works, Indianapolis.

PUMPS.
(Gas, Rotary Positive Pressure.)
Connersville Blower Co., The, Connersville, Ind.
Roots, P. H. & F. M., Co., Connersville, Ind.

PUMPS.
(Locomotive, Fire and Deck.)
Vanduzen, E. W., Co., The Cincinnati, O.

PUMPS.
(Vacuum.)
Buffalo Fdy. & Machine Co., Buffalo, N. Y.
Connersville Blower Co., The, Connersville, Ind.
Dean Bros. Steam Pump Works, Indianapolis.
Deming Co., Salem, O.
Mesta Machine Co., Pittsburgh, Pa.
Roots, P. H. & F. M., Co., Connersville, Ind.

PUNCHES.
(Hydraulic.)
Mesta Machine Co., Pittsburgh, Pa.
Southwark Fdy. & Mch. Co., Philadelphia, Pa.

PUNCHING AND SHEARING MACHINERY.
Allen, John F., Co., New York, N. Y.
Alliance Machine Co., Alliance, O.
Bellefonte Engrg. Works, Bellefonte, Pa.
Bertsch & Co., Cambridge City, Ind.
Bethlehem Steel Co., So. Bethlehem, Pa.
Bliss, E. W., Co., Brooklyn, N. Y.
Bourne-Fuller Co., The, Cleveland, O.
Cleveland Punch & Shear Works Co., Cleveland, O.
Covington Machine Co., Covington, Va.
Erie Foundry Co., Erie, Pa.
Hilles & Jones, Wilmington, Del.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Morgan Engineering Co., Alliance, O.
Niles-Bement-Pond Co., New York, N. Y.
Richards, I. T., Providence, R. I.
Ryerson, Jos. T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.
Standard Bridge Tool Co., Pittsburgh, Pa.
Tod, Wm., Co., Youngstown, O.
United Engrg & Fdy. Co., Pittsburgh, Pa.
Watson-Stillman Co., New York, N. Y.
Wood, R. D., & Co., Philadelphia, Pa.

PUSH BUTTONS.
Electric Controller & Mfg. Co., Cleveland, O.

PYROMETERS.
Brown Instrument Co., Pittsburgh, Pa.
Stupakoff Laboratories, Pittsburgh, Pa.
Thwing Instrument Co., Philadelphia, Pa.

RACKS.
(Steel or Tool.)
New Britain Mach. Co., New Britain, Conn.

RAIL JOINTS.
Carnegie Steel Co., Pittsburgh, Pa.
Lackawanna Steel Co., Buffalo, N. Y.

RAILROAD EQUIPMENT.
(Industrial.)
Lakewood Engrg. Co., Cleveland, O.

RAILROAD SUPPLIES.
U. S. Metal & Mfg. Co., New York City.

RAILS.
Zelnicker, Walter A., Supply Co., St. Louis, Mo.

RAMS.
Bethlehem Steel Co., So. Bethlehem, Pa.

REAMERS.
(Electric Portable.)
Van Dorn Electric Tool Co., Cleveland, O.

RECORDERS.
Thwing Instrument Co., Philadelphia, Pa.

REELS.
(Solid and Adjustable.)
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

REGULATORS.
(Automatic Pressure.)
Cutler-Hammer Mfg. Co., Milwaukee, Wis.

RELAYS.
(Pressure and Vacuum.)
Cutler-Hammer Mfg. Co., Milwaukee, Wis.

RHEOSTATS.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
Electric Controller & Mfg. Co., Cleveland, O.

RIVETERS.
(Hydraulic.)
Southwark Fdy. & Mch. Co., Philadelphia, Pa.
Wood, R. D., & Co., Philadelphia, Pa.

RIVETING MACHINERY.
Allen, John F., Co., New York, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cleveland Pneumatic Tool Co., Cleveland, O.
Oldham, Geo., & Sons Co., Frankfort, Philadelphia, Pa.
Ryerson, Jos. T., & Son, Chicago, Ill.

RIVETS.
American Iron & Steel Mfg. Co., Lebanon, Pa.
American Vanadium Co., The, Pittsburgh, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Illinois Steel Co., Warehouse Dept., Chicago, Ill.
Illinois Steel Warehouse Co., St. Louis, Mo.
Illinois Steel Warehouse Co., St. Paul, Minn.
Inland Steel Co., Chicago, Ill.
Lockhart Iron & Steel Co., Pittsburgh, Pa.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Oliver Iron & Steel Co., Pittsburgh, Pa.
Progressive Mfg. Co., Torrington, Conn.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Ryerson, Jos. T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.
Upson Nut Co., Cleveland, O.

ROAD GUARD FENCE.
(Concrete.)
Concrete Products Co., Pittsburgh, Pa.

RODS.
(Connecting.)
Leard, Wm. E., New Brighton, Pa.

RODS.
(Drill.)
Bourne-Fuller Co., The, Cleveland, O.

RODS.
(Iron and Steel.)
American Iron & Steel Mfg. Co., Lebanon, Pa.
Bethlehem Steel Co., So. Bethlehem, Pa.
Upson Nut Co., Cleveland, O.
Youngstown Sh't & Tube Co., Youngstown, O.

ROLL GRINDING MACHINES.
Norton Grinding Co., Worcester, Mass.

ROLLING MILL EQUIPMENT.
Abramsen Engrg. Co., Pittsburgh, Pa.
Alliance Machine Co., Alliance, O.
Blake & Johnson Co., Waterbury, Conn.
Birdsboro Steel Fdy. & Machine Co., Birdsboro, Pa.
Farrel Foundry & Machine Co., Ansonia, Conn.
Fawcus Machine Co., Pittsburgh, Pa.
Garrison, A., Foundry Co., Pittsburgh, Pa.
Hilles & Jones, Wilmington, Del.
Hyde Park Fdy. & Mch. Co., Hyde Park, Pa.
Hubbard Steel Fdy. Co., E. Chicago, Ind.
Industrial Works, Bay City, Mich.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Morgan Engineering Co., Alliance, O.
Morgan Construction Co., Worcester, Mass.
Newbold, R. S., & Son Co., Norristown, Pa.
Standard Engineering Co., Ellwood City, Pa.
Tod, Wm., Co., Youngstown, O.
Torrington Mfg. Co., Torrington, Conn.
Treadwell Engineering Co., Easton, Pa.
Wellman-Seaver-Morgan Co., Cleveland, O.
Wheeling Mold & Fdy. Co., Pittsburgh, Pa.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Youngstown Fdy. & Mch. Co., Youngstown, O.

ROLLS.
(Bending and Straightening.)
Bertsch & Co., Cambridge City, Ind.
Hilles & Jones, Wilmington, Del.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

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CASTINGS

PITTSBURGH MALLEABLE IRON CO.

MALLEABLE CASTINGS

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ZANESVILLE MALLEABLE CO.

MALLEABLE CASTINGS

ZANESVILLE, OHIO

General Machine and Pattern Work

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BELLEFONTE, PA.

Phosphor - Manganese Aluminum

BRONZE

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NF

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Pittsburgh Office, Farmers Bank Building

The Production of Malleable Castings

By DR. RICHARD MOLDENKE

A practical treatise on the processes involved in the manufacture of Malleable Cast Iron. The first and only book of its kind ever published.

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The Testing of Malleable Cast Iron.
The Pattern Shop.
Molding Methods in the Malleable Foundry.
Melting Processes.
The Construction and Operation of the Air Furnace.
Construction and Operation of the Open-Hearth Furnace.
The Use of Gas Producers in Malleable Foundries.
Mixing the Charges for Malleable Iron.
Casting Malleable Iron.
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Characteristics of Malleable Furnaces.
Use of Pyrometer in Annealing Room.
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Index.

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ROLLS.
(Sand Chilled and Steel).
American Steel Foundries, Chicago, Ill.
Bethlehem Steel Co., So. Bethlehem, Pa.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Farrell Fdy. & Mach. Co., Ansonia, Conn.
Garrison, A., Foundry Co., Pittsburgh, Pa.
Hubbard Steel Fdy. Co., E. Chicago, Ind.
Hyde Park Fdy. & Mach. Co., Hyde Park, Pa.
Mesta Machine Co., Pittsburgh, Pa.
National Roll & Foundry Co., Avonmore, Pa.
Pittsburgh Iron & Steel Foundries, Pittsburgh.
Seaman, Sleeth & Co., Pittsburgh, Pa.
Standard Engrg. Co., Ellwood City, Pa.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Youngstown Fdy. & Mach Co., Youngstown, O.

ROLLS.
(Wood.)
Dart, E. M., Mfg. Co., Providence, R. I.

ROOFING AND SIDING.
(Composite.)
American Sheet & Tin Plate Co., Pittsburgh.
Texas Company, The, New York City.

ROOFING AND SIDING.
(Iron and Steel.)
American Rolling Mill Co., Middletown, O.
American Sh't & Tin Plate Co., Pittsburgh.
Brier Hill Steel Co., Youngstown, O.
Canton Sheet Steel Co., Canton, O.
La Belle Iron Works, Youngstown, O.
Newport Rolling Mill Co., Newport, Ky.
Seneca Iron & Steel Co., Buffalo, N. Y.
Stark Rolling Mill Co., Canton, O.
Western Reserve Steel Co., Warren, O.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Wood, Alan, Iron & Steel Co., Philadelphia.
Youngstown Iron & Steel Co., Youngstown, O.
Youngstown Sh't & Tube Co., Youngstown, O.

ROPE DRESSING.
Texas Company, The, New York City.

RUNNING GEAR WHEELS, AXLES AND BEARINGS.
Lakewood Engrg. Co., Cleveland, O.

SADDLES.
Worth Brothers Co., Philadelphia, Pa.

SAND.
(Molding.)
Gordon Sand Co., Inc., The, Conneaut, O.
Standard Sand & Machine Co., Cleveland, O.

SAND BLAST.
(Shot.)
Globe Steel Co., Mansfield, O.

SAND CONVEYING AND HANDLING MACHINERY.
Standard Sand & Machine Co., Cleveland, O.

SAND MIXING MACHINERY.
Standard Sand & Machine Co., Cleveland, O.

SAND SIFTERS.
Arcade Mfg. Co., Freeport, Ill.
Standard Sand & Machine Co., Cleveland, O.
Whiting Fdy. & Equip. Co., Harvey, Ill.

SASH.
(Steel Casement.)
Trussed Concrete Steel Co., Detroit, Mich.

SAWS.
(Cold and Hot Metal.)
Disston, Henry & Sons, Inc., Philadelphia, Pa.
Espen-Lucas Mch. Works, Philadelphia, Pa.
Hunter Saw & Machine Co., Pittsburgh, Pa.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Newton Mach. Tool Works, Inc., Philadelphia, Pa.
Simonds Mfg. Co., Fitchburg, Mass.
United Engrg & Fdy. Co., Pittsburgh, Pa.

SAWS.
(Hack.)
Disston, Henry & Sons, Inc., Philadelphia, Pa.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Peerless Machine Co., Racine, Wis.
Simonds Mfg. Co., Fitchburg, Mass.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

SAWS.
(Inserted Tooth.)
Hunter Saw & Mch. Co., Pittsburgh, Pa.

SAW SHARPENING MACHINES.
Disston, Henry & Sons, Inc., Philadelphia, Pa.

SCALES.
(Automatic Dial.)
Standard Scale & Supply Co., Pittsburgh, Pa.

SCALES.
(Automobile.)
Standard Scale & Supply Co., Pittsburgh, Pa.

SCALES.
(Hopper.)
Standard Scale & Supply Co., Pittsburgh, Pa.

SCALES.
(Railroad.)
Standard Scale & Supply Co., Pittsburgh, Pa.

SCALES.
(Track.)
Standard Scale & Supply Co., Pittsburgh, Pa.

SCALES, CARS AND BOXES.
Lakewood Engrg. Co., Cleveland, O.

SCREENS.
Hendrick Mfg. Co., Carbondale, Pa.

SCREENS.
(Coal and Sand.)
Standard Sand & Machine Co., Cleveland, O.
Wright Wire Co., Worcester, Mass.

SCREENS.
(Pulsating and Revolving.)
Chalmers & Williams, Chicago Heights, Ill.
Link-Belt Co., Chicago, Ill.

SCREW MACHINE PRODUCTS.
(Special.)
Acme Mfg. Co., Boonton, N. J.
Murcott-Duden Co., New York City.
Standard Screw Products Co., Detroit, Mich.

SCREW STOCK.
(Free Cutting.)
Columbia Steel & Shafting Co., Pittsburgh, Pa.

SCREWS.
American Iron & Steel Mfg. Co., Lebanon, Pa.
Clark Bros. Bolt Co., Millidale, Conn.
Milton Mfg. Co., Milton, Pa.
Progressive Mfg. Co., Torrington, Conn.
Republic Iron & Steel Co., Youngstown, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

SECOND HAND MACHINERY.
Baird Machy. Co., Pittsburgh, Pa.
Moore, Edgar M., & Co., Pittsburgh, Pa.
Niles-Bement-Pond Co., New York, N. Y.
Ryerson, Jos. T., & Son, Chicago, Ill.
Zelnicker, Walter A., Supply Co., St. Louis, Mo.

SEPARATORS—SAW DUST.
(Nail.)
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

SHAFT HANGERS.
New Departure Mfg. Co., Bristol, Conn.

SHAFTING.
American Vanadium Co., The, Pittsburgh, Pa.
Bethlehem Steel Co., So. Bethlehem, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Cincinnati Iron & Steel Co., Cincinnati, O.
Columbia Steel & Shafting Co., Pittsburgh, Pa.
Cumberland Steel Co., Cumberland, Md.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
National Tube Co., Pittsburgh, Pa.
Republic Iron & Steel Co., Youngstown, O.
Scully Steel & Iron Co., Chicago, Ill.
Standard Gauge Steel Co., Beaver Falls, Pa.
Union Drawn Steel Co., Beaver Falls, Pa.

SHAFTING.
(Turned and Polished.)
Bourne-Fuller Co., The, Cleveland, O.

SHAPERS.
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Manning, Maxwell & Moore, Inc., New York, N. Y.
Morton Mfg. Co., Muskegon Heights, Mich.
Newton Mach. Tool Wks., Inc., Philadelphia.
Niles-Bement-Pond Co., New York, N. Y.

SHAPES.
(Iron and Steel.)
American Vanadium Co., The, Pittsburgh, Pa.
Belmont Iron Works, Philadelphia, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Cambria Steel Co., Philadelphia, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Columbia Steel & Shafting Co., Pittsburgh, Pa.
Illinois Steel Co., Chicago, Ill.
Laclede Steel Co., St. Louis, Mo.
Moltrup Steel Products Co., Beaver Falls, Pa.
Republic Iron & Steel Co., Youngstown, O.
Scully Steel & Iron Co., Chicago, Ill.

SHAPES.
(Wire, Flat and Round.)
Cuyahoga Spring Co., Cleveland, O.

SHEAR BLADES AND KNIVES.
Trethewey Samuel, & Co., Pittsburgh, Pa.
White, L. & I. J., Co., Buffalo, N. Y.

SHEARS.
(Alligator.)
Youngstown Fdy. & Mch. Co., Youngstown, O.

SHEARS.
(Angle and Plate.)
Bertsch & Co., Cambridge City, Ind.
Bliss, E. W., Co., Brooklyn, N. Y.
Erie Foundry Co., Erie, Pa.
Garrison, A., Foundry Co., Pittsburgh, Pa.
Hilles & Jones, Wilmington, Del.
Mesta Machine Co., Pittsburgh, Pa.
Tod, Wm., Co., Youngstown, O.
Toledo Machine & Tool Co., Toledo, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

SHEARS.
(Billet, Bloom and Slab.)
Garrison, A., Foundry Co., Pittsburgh, Pa.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Tod, Wm., Co., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

SHEARS.
(Flying and Bar.)
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Morgan Construction Co., Worcester, Mass.

SHEARS.
(Hydraulic.)
Southwark Fdy. & Mch. Co., Philadelphia, Pa.

SHEARS.
(Lever.)
Mesta Machine Co., Pittsburgh, Pa.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Watson & Stillman Co., New York, N. Y.
Youngstown Fdy. & Mch. Co., Youngstown, O.

SHEARS.
(Portable.)
Watson-Stillman Co., New York, N. Y.

SHEARS.
(Scrap Wire.)
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

SHEET BARS.
Carnegie Steel Co., Pittsburgh, Pa.
Central Steel Co., The, Massillon, O.
Illinois Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
Lackawanna Steel Co., Buffalo, N. Y.
Republic Iron & Steel Co., Youngstown, O.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.
Youngstown Iron & Steel Co., Youngstown, O.

SHEETS.
Allegheny Steel Co., Pittsburgh, Pa.
American Rolling Mill Co., Middletown, O.
American Sheet & Tin Plate Co., Pittsburgh.
American Vanadium Co., The, Pittsburgh, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Canton Sheet Steel Co., Canton, O.
Disston & Sons, Inc., Henry, Philadelphia, Pa.
Erdle Perforating Co., Rochester, N. Y.
Illinois Steel Co., Chicago, Ill.
Illinois Steel Co., Warehouse Dept., Chicago, Ill.
Illinois Steel Warehouse Co., St. Louis, Mo.
Illinois Steel Warehouse Co., St. Paul, Minn.
La Belle Iron Works, Steubenville, O.
Newport Rolling Mill Co., Newport, Ky.
Republic Iron & Steel Co., Youngstown, O.
Ryerson, Jos. T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.
Seneca Iron & Steel Co., Buffalo, N. Y.
Stark Rolling Mill Co., Canton, O.
Tenn. Coal, Iron & R. R. Co., Birmingham, Ala.
Trumbull Steel Co., Warren, O.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Wood, Alan, Iron & Steel So., Philadelphia, Pa.
Worth Bros. Co., Philadelphia, Pa.
Youngstown Sheet & Tube Co. Youngstown, O.

SHEETS.
(Black)
American Sheet & Tin Plate Co., Pittsburgh.
Bourne-Fuller Co., The, Cleveland, O.
Brier Hill Steel Co., Youngstown, O.
Canton Sheet Steel Co., Canton, O.
Cincinnati Iron & Steel Co., Cincinnati, O.
Inland Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
Newport Rolling Mill Co., Newport, Ky.
Ryerson, Joseph T., & Son, Chicago, Ill.
Seneca Iron & Steel Co., Buffalo, N. Y.
Stark Rolling Mill Co., Canton, O.
Western Reserve Steel Co., Warren, O.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Youngstown Iron & Steel Co., Youngstown, O.
Youngstown Sh't & Tube Co., Youngstown, O.

SHEETS.
(Blue Annealed.)
American Rolling Mill Co., Middletown, O.
American Sheet & Tin Plate Co., Pittsburgh.
Bourne-Fuller Co., The, Cleveland, O.
Canton Sheet Steel Co., Canton, O.
Cincinnati Iron & Steel Co., Cincinnati, O.
La Belle Iron Works, Steubenville, O.
Newport Rolling Mill Co., Newport, Ky.
Seneca Iron & Steel Co., Buffalo, N. Y.
Stark Rolling Mill Co., Canton, O.
Western Reserve Steel Co., Warren, O.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Youngstown Sheet & Tube Co., Youngstown, O.

SHEETS.
(Cold Rolled.)
Bourne-Fuller Co., The, Cleveland, O.
Inland Steel Co., Chicago, Ill.
Newport Rolling Mill Co., Newport, Ky.
Stark Rolling Mill Co., Canton, O.
Western Reserve Steel Co., Warren, O.
Youngstown Sh't & Tube Co., Youngstown, O.

SHEETS.
(Corrugated.)
American Rolling Mill Co., Middletown, O.
American Sheet & Tin Plate Co., Pittsburgh.
Bourne-Fuller Co., The, Cleveland, O.
Brier Hill Steel Co., Youngstown, O.
Canton Sheet Steel Co., Canton, O.
Cincinnati Iron & Steel Co., Cincinnati, O.
Inland Steel Co., Chicago, Ill.
La Belle Iron Works, Stenbenville, O.
Newport Rolling Mill Co., Newport, Ky.
Ryerson, Joseph T., & Son, Chicago, Ill.
Seneca Iron & Steel Co., Buffalo, N. Y.
Stark Rolling Mill Co., Canton, O.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.
Trumbull Steel Co., Warren, O.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Youngstown Iron & Steel Co., Youngstown, O.
Youngstown Sh't & Tube Co., Youngstown, O.

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FORGINGS

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Rams and Dies are set at an angle with the frame, and work of full width of dies, and of any length will clear the frame when drawing or finishing.
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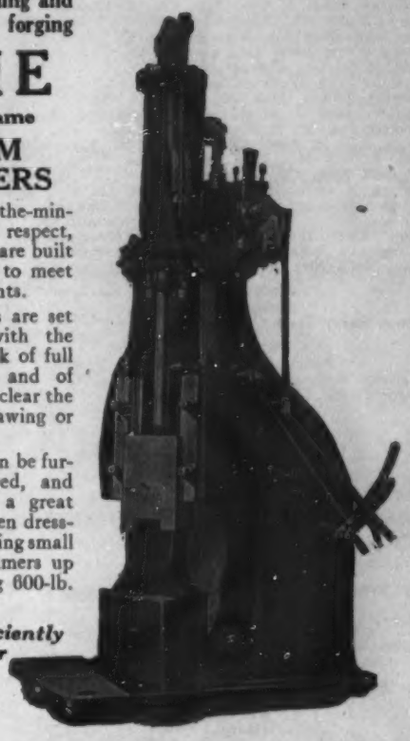
Operates efficiently with either air or steam.



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SHEETS.
(Dead Soft.)
American Rolling Mill Co., Middletown, O.
American Sheet & Tin Plate Co., Pittsburgh.
Bourne-Fuller Co., The, Cleveland, O.
Canton Sheet Steel Co., Canton, O.
La Belle Iron Works, Steubenville, O.
Seneca Iron & Steel Co., Buffalo, N. Y.
Stark Rolling Mill Co., Canton, O.
Western Reserve Steel Co., Warren, O.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Youngstown Iron & Steel Co., Youngstown, O.
Youngstown Sh't & Tube Co., Youngstown, O.

SHEETS.
(Galvanized.)
Allegheny Steel Co., Pittsburgh, Pa.
American Sheet & Tin Plate Co., Pittsburgh.
Bourne-Fuller Co., The, Cleveland, O.
Brier Hill Steel Co., Youngstown, O.
Canton Sheet Steel Co., Canton, O.
Inland Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
Newport Rolling Mill Co., Newport, Ky.
Republic Iron & Steel Co., Youngstown, O.
Ryerson, Jos. T., & Son, Chicago, Ill.
Seneca Iron & Steel Co., Buffalo, N. Y.
Stark Rolling Mill Co., Canton, O.
Trumbull Steel Co., Warren, O.
Western Reserve Steel Co., Warren, O.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Wood, Alan, Iron & Steel Co., Philadelphia.
Youngstown Iron & Steel Co., Youngstown, O.
Youngstown Sh't & Tube Co., Youngstown, O.

SHEETS.
(Long Terne.)
Canton Sheet Steel Co., Canton, O.

SHEETS.
(Polished and Planished.)
American Rolling Mill Co., Middletown, O.
Bourne-Fuller Co., The, Cleveland, O.

SHEETS.
(Roofing.)
(See Roofing and Siding.)

SHEET IRON WORK.
Hendrick Mfg. Co., Carbondale, Pa.

SHEET METAL WORKING MACHINERY.
Bliss, E. W., Co., Brooklyn, N. Y.

SHELVING.
(Steel.)
New Britain Mach. Co., New Britain, Conn.

SHINGLES.
(Galvanized and Terne Painted.)
Canton Sheet Steel Co., Canton, O.

SHOP BOXES AND CANS.
New Britain Machine Co., New Britain, Conn.

SIGNS.
(Metal.)
Beecher-Fowler Mfg. Co., Louisville, Ky.

SLABS.
Cambria Steel Co., Philadelphia, Pa.
La Belle Iron Works, Steubenville, O.
Lackawanna Steel Co., Buffalo, N. Y.
Tenn. Coal, Iron & R. R. Co., Birmingham, Ala.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Youngstown Sh't & Tube Co., Youngstown, O.

SLEEVES AND NOZZLES.
Manown Mfg. Co., Pittsburgh, Pa.

SPECIAL SHAPE WIRE.
Roebling's, John A., Sons Co., Trenton, N. J.

SPELTER.
Amer. Zinc. Lead & Smelt'g Co., New York.

SPIKES.
American Iron & Steel Mfg. Co., Lebanon, Pa.
Illinois Steel Co., Chicago, Ill.
Inland Steel Co., Chicago, Ill.
Republic Iron & Steel Co., Youngstown, O.

SPRINGS.
American Vanadium Co., Pittsburgh, Pa.
Cuyahoga Spring Co., Cleveland, O.
Duer Spring & Mfg. Co., Pittsburgh, Pa.

SPRINGS.
(Wire.)
Raymond Mfg. Co., Corry, Pa.

SQUEEZER.
(Power.)
Pridmore, Henry E., Chicago, Ill.

SQUEEZER MOLDING MACHINE.
Pridmore, Henry E., Chicago, Ill.

STACKS.
(Steel.)
American Bridge Co., New York, N. Y.

STAMPINGS.
(Sheet Metal.)
Bettcher Mfg. Co., Cleveland, O.
Erdle Perforating Co., Rochester, N. Y.
Hubbard & Company, Pittsburgh, Pa.
Lansing Stamping & Tool Co., Lansing, Mich.
Metal Specialty Co., Cincinnati, O.
New Britain Mch. Co., New Britain, Conn.

STAMPS.
(Steel.)
Matthews, Jas. H., & Co., Pittsburgh, Pa.

STARTERS.
(Electric Motor.)
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
Crocker-Wheeler Co., Ampere, N. J.
Electric Controller & Mfg. Co., Cleveland, O.
General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

STAYBOLT IRON.
American Iron & Steel Mfg. Co., Lebanon, Pa.
Bourne-Fuller Co., The, Cleveland, O.

STEAM TRAPS.
National Tube Co., Pittsburgh, Pa.

STEEL.
American Bridge Co., New York, N. Y.
American Vanadium Co., Pittsburgh, Pa.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Cambria Steel Co., Philadelphia, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Central Steel Co., The, Massillon, O.
Disston Sons, Inc., Henry, Philadelphia, Pa.
Franklin Steel Works, Franklin, Pa.
Illinois Steel Co., Chicago, Ill.
Illinois Steel Co., Warehouse Dept., Chicago, Ill.
Illinois Steel Warehouse Co., St. Louis, Mo.
Illinois Steel Warehouse Co., St. Paul, Minn.
La Belle Iron Works, Steubenville, O.
Latrobe Electric Steel Co., Latrobe, Pa.
Lindenberg Steel Co., New York City.
Otis Steel Co., Cleveland, O.
Racine Steel Castings Co., Racine, Wis.
Republic Iron & Steel Co., Youngstown, O.
Ryerson, Jos. T., & Son, Chicago, Ill.
Simonds Mfg. Co., Lockport, N. Y.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.
United Steel Co., Canton, O.
Upson Nut Co., Cleveland, O.
Vanadium Alloys Steel Co., Pittsburgh, Pa.
West Leechburg Steel Co., Pittsburgh, Pa.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Wood, Alan, Iron & Steel Co., Philadelphia.
Youngstown Sheet & Tube Co., Youngstown, O

STEEL.
(Alloy.)
Andrews Steel Co., Newport, Ky.
Central Steel Co., The, Massillon, O.
Columbia Steel & Shafting Co., Pittsburgh, Pa.
Lindenberg Steel Co., New York City.
Murcott-Duden Co., New York City.
Union Drawn Steel Co., Beaver Falls, Pa.
United Steel Co., Canton, O.

STEEL.
(Carbon.)
Latrobe Electric Steel Co., Latrobe, Pa.
Lindenberg Steel Co., New York City.

STEEL.
(Cold Drawn and Rolled.)
Bourne-Fuller Co., The, Cleveland, O.
Columbia Steel & Shaft'g Co., Pittsburgh, Pa.
Moltrup Steel Products Co., Beaver Falls, Pa.
Pittsburgh Cold Rolled Steel Co., Pittsburgh, Pa.
Scully Steel & Iron Co., Chicago, Ill.
Simonds Mfg. Co., Lockport, N. Y.
Standard Gauge Steel Co., Beaver Falls, Pa.
Union Drawn Steel Co., Beaver Falls, Pa.
United Steel Co., Canton, O.

STEEL.
(Die.)
Firth-Sterling Steel Co., McKeesport, Pa.
Latrobe Electric Steel Co., Latrobe, Pa.

STEEL.
(Electric Furnace.)
Andrews Steel Co., Newport, Ky.
Illinois Steel Co., Chicago, Ill.
Latrobe Electric Steel Co., Latrobe, Pa.
Racine Steel Castings Co., Racine, Wis.
United Steel Co., Canton, O.

STEEL.
(High Speed.)
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Firth-Sterling Steel Co., McKeesport, Pa.
Latrobe Electric Steel Co., Latrobe, Pa.
Lindenberg Steel Co., New York City.
Racine Steel Castings Co., Racine, Wis.
Vanadium Alloys Steel Co., Pittsburgh, Pa.

STEEL.
(Manganese.)
Central Steel Co., The, Massillon, O.

STEEL.
(Nickel.)
Latrobe Electric Steel Co., Latrobe, Pa.
United Steel Co., Canton, O.

STEEL.
(Open-Hearth.)
Bourne-Fuller Co., The, Cleveland, O.
Cambria Steel Co., Philadelphia, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Columbia Steel & Shaft'g Co., Pittsburgh, Pa.
Illinois Steel Co., Chicago, Ill.
Inland Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
Pennsylvania Products Co., Pine Forge, Pa.
Union Drawn Steel Co., Beaver Falls, Pa.
Upson Nut Co., Cleveland, O.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.

STEEL.
(Semi.)
McLain's System, Milwaukee, Wis.

STEEL.
(Special Analysis.)
Andrews Steel Company, Newport, Ky.
Central Steel Co., The, Massillon, O.
Simonds Mfg. Co., Lockport, N. Y.

STEEL.
(Spring.)
Cambria Steel Co., Philadelphia, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
United Steel Co., Canton, O.

STEEL.
(Structural.)
Alliance Structural Co., Alliance, O.
American Bridge Co., New York, N. Y.
Beals & Company, Buffalo, N. Y.
Bellefontaine Bridge & Steel Co., The, Bellefontaine, O.
Belmont Iron Works, Philadelphia, Pa.
Bethlehem Steel Co., South Bethlehem, Pa.
Elaw Steel Construction Co., Hoboken, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Cambria Steel Co., Philadelphia, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Cincinnati Iron & Steel Co., Cincinnati, O.
Eichleay, John Jr., Co., Pittsburgh, Pa.
Franklin Steel Works, Franklin, Pa.
Illinois Steel Co., Chicago, Ill.
Illinois Steel Co., Warehouse Dept., Chicago, Ill.
Illinois Steel Warehouse Co., St. Louis, Mo.
Illinois Steel Warehouse Co., St. Paul, Minn.
Inland Steel Co., Chicago, Ill.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Lackawanna Steel Co., Buffalo, N. Y.
Lockhart Iron & Steel Co., Pittsburgh, Pa.
McClintic-Marshall Co., Pittsburgh, Pa.
Moltrup Steel Products Co., Beaver Falls, Pa.
Republic Iron & Steel Co., Youngstown, O.
Ryerson, Joseph T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.

STEEL.
(Tool.)
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Cincinnati Iron & Steel Co., Cincinnati, O.
Firth-Sterling Steel Co., McKeesport, Pa.
Latrobe Electric Steel Co., Latrobe, Pa.
Lindenberg Steel Co., New York City.
Racine Steel Castings Co., Racine, Wis.
Ryerson, Joseph T., & Son, Chicago, Ill.
Vanadium Alloys Steel Co., Pittsburgh, Pa.

STEEL.
(Vanadium.)
American Vanadium Co., Pittsburgh, Pa.
Latrobe Electric Steel Co., Latrobe, Pa.
United Steel Co., Canton, O.

STEEL STAMPS.
Pannier Bros. Stamp Co., Pittsburgh, Pa.
Weber-Erickson-Bunting Co., Pittsburgh, Pa.

STOKERS.
Babcock & Wilcox, The, New York City.
Erie Foundry Co., Erie, Pa.
Green Engineering Co., Chicago, Ill.
Hagan, Geo. J., Co., Pittsburgh, Pa.

STOOLS.
(Steel.)
Angle Steel Stool Co., Otsego, Mich.

STRAND.
(Common, Special Strength.)
Roebling's, John A., Sons Co., Trenton, N. J.

STRAP JOINTS.
Leard, Wm. E., New Brighton, Pa.

STRAPS.
Bethlehem Steel Co., So. Bethlehem, Pa.

STRAIGHTENING MACHINERY.
Abramsen Engineering Co., Pittsburgh, Pa.

SULPHURIC ACID.
Amer. Zinc Lead & Smelt'g Co., New York.

SWITCHBOARDS.
Electric Controller & Mfg. Co., Cleveland, O.

SWITCHES.
(Electric.)
Electric Controller & Mfg. Co., Cleveland, O.
General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

SYNDOLAG.
Davison, Allen S., Co., Pittsburgh, Pa.

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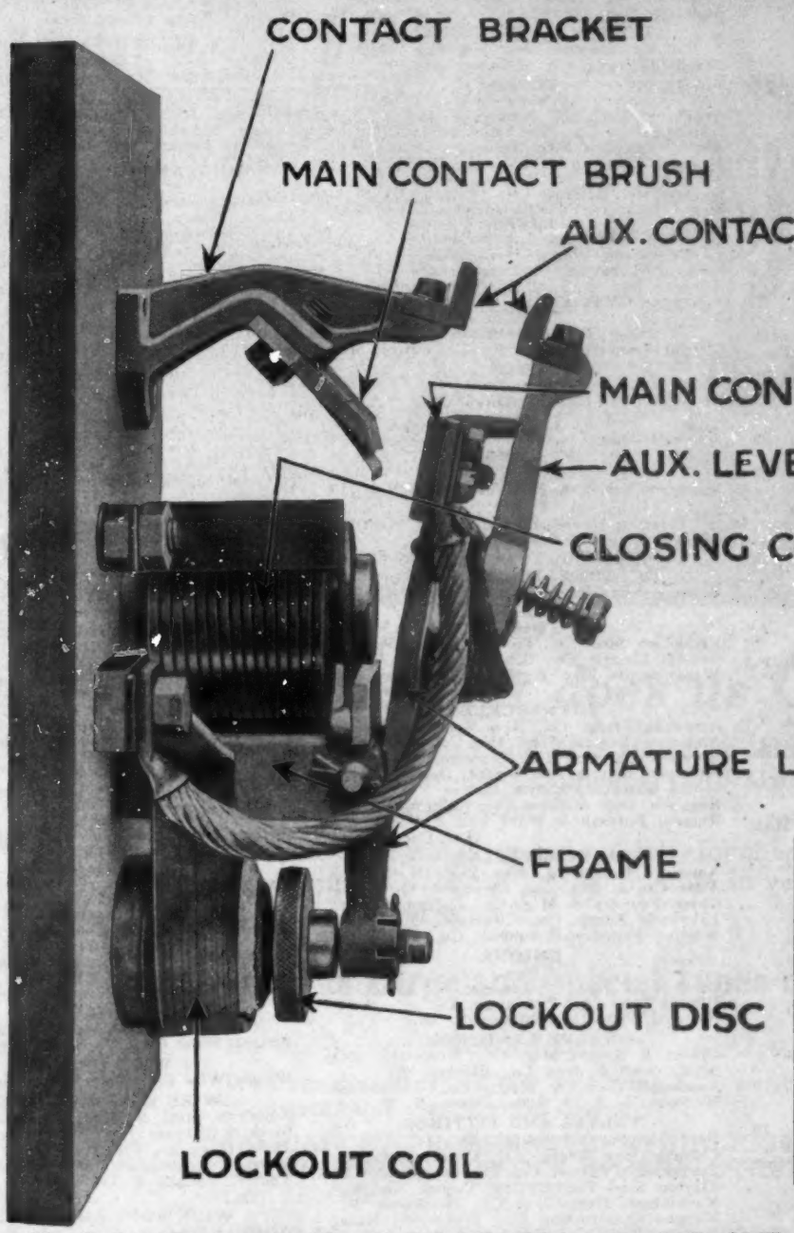
Magnetic Lock-Out Switches

Engineers whose experience has brought them in contact with magnetic switch control recognize the advantages of the design and construction of Cutler-Hammer Magnetic Lock-Out (Series Wound) Switches. Several of these are noted below:



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TANKS.
(Acetylene.)
National Tube Co., Pittsburgh, Pa.
Prest-O-Lite, The, Co., Indianapolis, Ind.

TANKS.
(Acid Storage.)
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

TANKS.
(Steel.)
American Bridge Co., New York, N. Y.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Hauser-Stander Tank Co., The, Cincinnati, O.
Morgan Construction Co., Worcester, Mass.
National Tube Co., Pittsburgh, Pa.
Riter-Conley Mfg. Co., Pittsburgh, Pa.

TANKS.
(Wooden.)
Hauser-Stander Tank Co., Cincinnati, O.

TAR EXTRACTORS.
Smith Gas Engrg. Co., The, Lexington, O.

TELEGRAPH AND TELEPHONE WIRE.
Roebling's, John A., Sons Co., Trenton, N. J.

THERMOMETERS.
Brown Instrument Co., Philadelphia, Pa.

THREAD CUTTING TOOLS.
Landis Machine Co., Waynesboro, Pa.

TILE.
(Fire Clay.)
Trussed Concrete Steel Co., Detroit, Mich.
Union Mining Co., Mt. Savage, Md.

TIME AND TOOL CHECKS.
Weber-Erickson-Bunting Co., Pittsburgh, Pa.

TIN PLATE.
American Sheet & Tin Plate Co., Pittsburgh.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Standard Tin Plate Co., Canonsburg, Pa.
Trumbull Steel Co., The, Warren, O.

TIN PLATE MILL EQUIPMENT.
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
United Eng. & Fdy. Co., Pittsburgh, Pa.

TIRES.
(Steel.)
American Vanadium Co., The, Pittsburgh, Pa.

TITANIUM.
Titanium Alloy Mfg. Co., Niagara Falls, N. Y.

TOOLS.
(Electric.)
General Electric Co., Schenectady, N. Y.

TOOLS.
(Hydraulic.)
Southwark Fdy. & Mch. Co., Philadelphia, Pa.

TOOLS.
(Pneumatic.)
Cleveland Pneumatic Tool Co., Cleveland, O.
Oldham, Geo., & Sons Co., Frankford, Philadelphia, Pa.
Ryerson, Jos. T., & Son, Chicago, Ill.

TOOLS.
(Special Machinery.)
Lansing Stamping & Tool Co., Lansing, Mich.

TOOLS.
(Woodworking.)
White, L. & I. J., Co., Buffalo, N. Y.

TORCHES.
(Acetylene, Blow, Oxyacetylene.)
Prest-O-Lite, The, Co., Indianapolis, Ind.

TRACK.
(Industrial.)
Atlas Car & Mfg. Co., Cleveland, O.
Chase Foundry & Mfg. Co., Columbus, O.

TRACK AND RAIL SUPPLIES.
Bethlehem Steel Co., So. Bethlehem, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Carnegie Steel Co., Pittsburgh, Pa.
Illinois Steel Co., Chicago, Ill.
Illinois Steel Co., Warehouse Dept., Chicago, Ill.
Illinois Steel Warehouse Co., St. Louis, Mo.
Illinois Steel Warehouse Co., St. Paul, Minn.
Lackawanna Steel Co., Buffalo, N. Y.
Lakewood Engineering Co., Cleveland, O.
Republic Iron & Steel Co., Youngstown, O.
Tenn. Coal, Iron & R. R. Co., Birmingham, Ala.

TRAMRAILS.
(Overhead Systems.)
Brown Hoisting Machinery Co., Cleveland, O.
Whiting Foundry Equipment Co., Harvey, Ill.

TRAMWAYS.
Link-Belt. Co., Chicago, Ill.

TRANSFORMERS.
General Electric Co., Schenectady, N. Y.

TRANSMISSION CHAINS.
Link-Belt Co., Chicago, Ill.

TRANSMISSION TOWERS.
Blaw Steel Construction Co., Hoboken, Pa.

TROLLEYS.
Browning Co., Cleveland, O.
Chisholm & Moore Mfg. Co., Cleveland, O.
Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.
Whiting Foundry Equipment Co., Harvey, Ill.

TRUCKS.
(Foundry.)
Standard Scale & Supply Co., Pittsburgh, Pa.

TRUCKS.
(Industrial.)
Lakewood Engrg. Co., Cleveland, O.
Morgan Construction Co., Worcester, Mass.
Whiting Foundry Equipment Co., Harvey, Ill.

TRUCKS.
(Rod, Show, Box, Wire Mills.)
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

TRUCKS.
(Small, Hand.)
Standard Scale & Supply Co., Pittsburgh, Pa.

TUBE MILL MACHINERY.
(Seamless and Welded.)
Standard Engrg. Co., Ellwood City, Pa.

TUBES.
(Boiler.)
Allegheny Steel Co., Pittsburgh, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Detroit Seamless Steel Tubes Co., Detroit, Mich.
National Tube Co., Pittsburgh, Pa.
Ryerson, Joseph T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.
Worth Brothers Co., Philadelphia, Pa.

TUBES.
(Butt and Lap Welded.)
La Belle Iron Works, Steubenville, O.
National Tube Co., Pittsburgh, Pa.
Republic Iron & Steel Co., Youngstown, O.
Youngstown Sh't & Tube Co., Youngstown, O.

TUBES.
(Cold Drawn Seamless Steel.)
Detroit Seamless Steel Tubes Co., Detroit, Mich.

TUBES.
(Seamless Steel.)
National Tube Co., Pittsburgh, Pa.

TUBING.
National Tube Co., Pittsburgh, Pa.

TUBING.
(Vanadium Steel.)
American Vanadium Co., The, Pittsburgh, Pa.

TUBS.
(Cleaning House and Galvanizing Plant.)
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

TUMBLING MILLS.
Whiting Fdy. Equipment Co., Harvey, Ill.

TURBINES.
(Steam.)
Bethlehem Steel Co., So. Bethlehem, Pa.
General Electric Co., Schenectady, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

TURNBUCKLES.
American Bridge Co., New York, N. Y.
American Iron & Steel Mfg. Co., Lebanon, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Michigan Bolt & Nut Works, Detroit, Mich.
Milton Mfg. Co., Milton, Pa.
Republic Iron & Steel Co., Youngstown, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

TURNTABLES.
American Bridge Co., New York, N. Y.
Atlas Car & Mfg. Co., Cleveland, O.
Chase Foundry & Mfg. Co., Columbus, O.
Lakewood Engrg. Co., Cleveland, O.
Whiting Foundry Equipment Co., Harvey, Ill.

UNIONS.
(Pipe.)
Dart, E. M., Co., Providence, R. I.
Illinois Tube Co., Pittsburgh, Pa.
National Tube Co., Pittsburgh, Pa.

VALVE LEATHERS.
Graton & Knight Mfg. Co., Worcester, Mass.
Scully Steel & Iron Co., Chicago, Ill.
Southwark Fdy. & Mach. Co., Philadelphia.
Williams, I. B., & Sons, Dover, N. H.

VALVES AND FITTINGS.
Best Company, Pittsburgh, Pa.
Chambersburg Engrg. Co., Chambesburg, Pa.
Connersville Blower Co., The, Connersville, Ind.
Dayton Steel Foundry Co., Dayton, O.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Morgan Construction Co., Worcester, Mass.
National Tube Co., Pittsburgh, Pa.
Pittsburgh Piping & Equip. Co., Pittsburgh.
Watson-Stillman Co., Pittsburgh, Pa.

VALVES AND FITTINGS.
(Hydraulic.)
Southwark Fdy. & Mch. Co., Philadelphia, Pa.

VANADIUM.
American Vanadium Co., Pittsburgh, Pa.

VATS.
(Acid and Chemical.)
Hauser-Stander Tank Co., The, Cincinnati, O.

WARRANTS.
(Pig Iron.)
American Pig Iron Storage Warrant Co., New York City.
Wheeler, Chas. Child, New York City.

WASHED METAL.
Brier Hill Steel Co., Youngstown, O.

WASHERS.
(Iron and Steel.)
American Iron & Steel Mfg. Co., Lebanon, Pa.
Bettcher Mfg. Co., Cleveland, O.
Bourne-Fuller Co., The, Cleveland, O.
Hubbard & Company, Pittsburgh, Pa.
Milton Mfg. Co., Milton, Pa.
Oliver Iron & Steel Co., Pittsburgh, Pa.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Upson Nut Co., Cleveland, O.
Wrought Washer Mfg. Co., Milwaukee, Wis.

WASHERS.
(Leather.)
Graton & Knight Co., The, Worcester, Mass.
Williams, I. B., & Sons, Dover, N. H.

WATER CINDER MILLS.
Whiting Foundry Equipment Co., Harvey, Ill.

WELDED PRODUCTS.
(Electric.)
Standard Screw Products Co., Detroit, Mich.

WELDING.
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(Oxy-Acetylene Process.)
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Lakewood Engrg. Co., Cleveland, O.

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(Car.)
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Carnegie Steel Co., Pittsburgh, Pa.
National Malleable Casting Co., Cleveland, O.

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(Rope.)
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Mesta Machine Co., Pittsburgh, Pa.

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Dayton Steel Foundry Co., Dayton, O.

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(Reversible.)
Lowell Wrench Co., Worcester, Mass.

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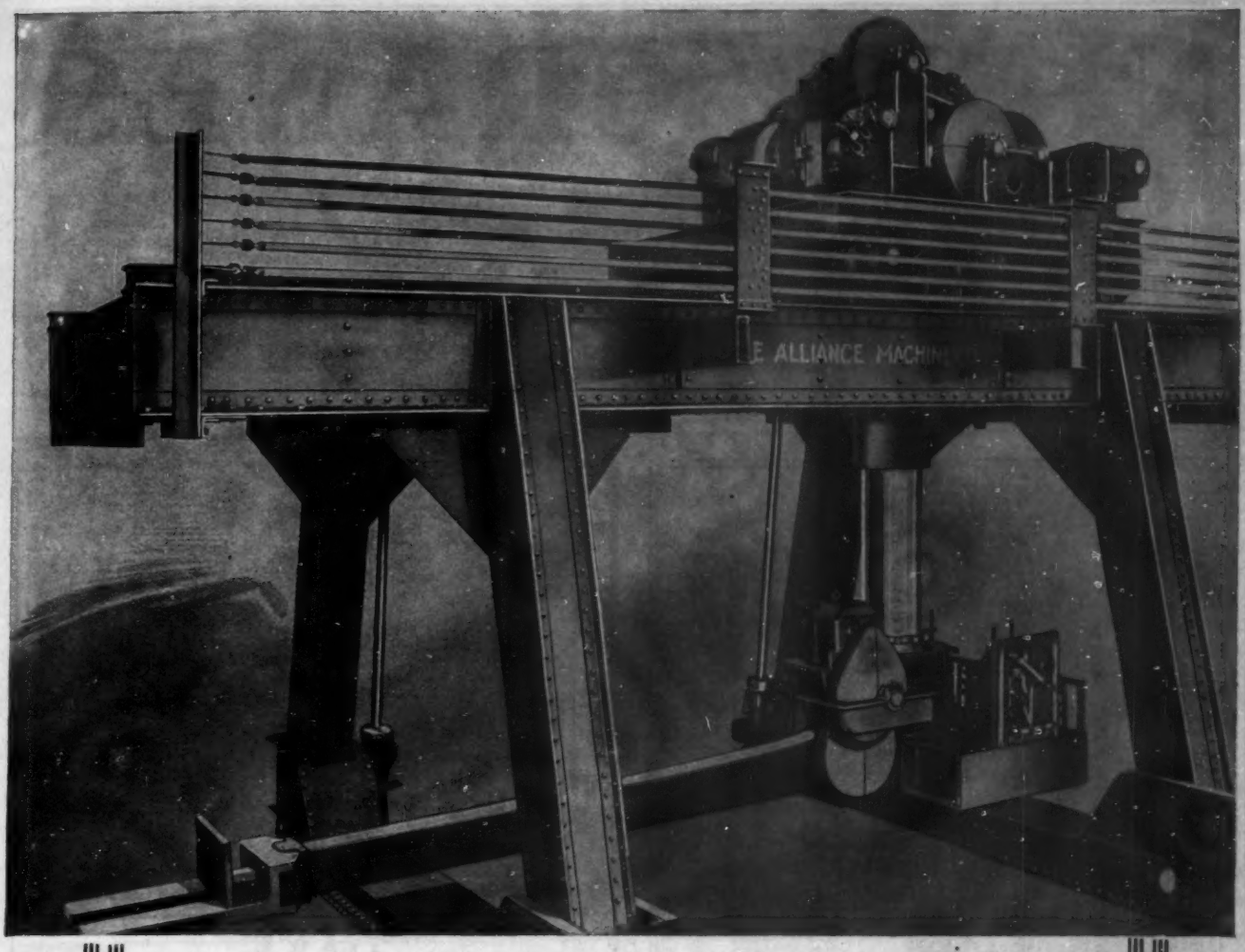

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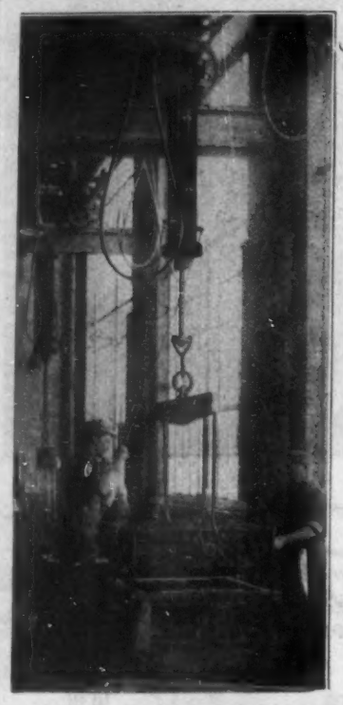

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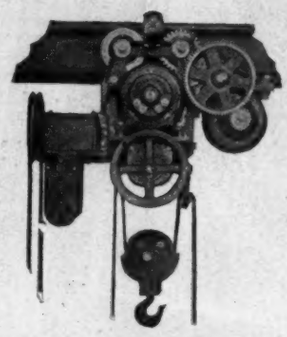

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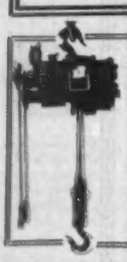

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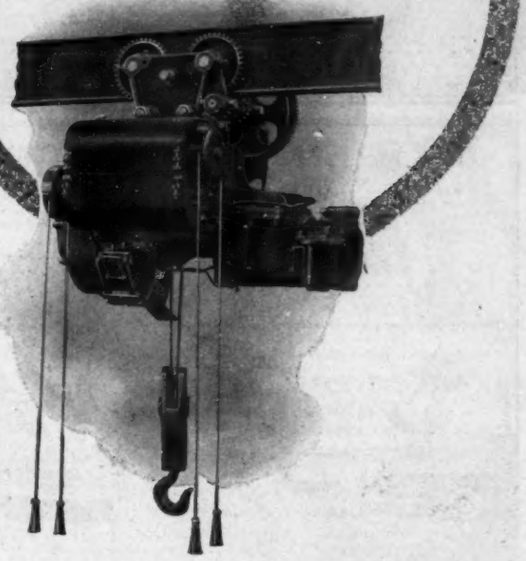

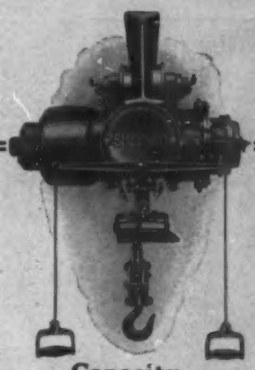

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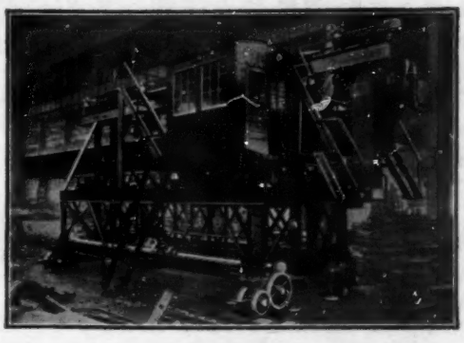

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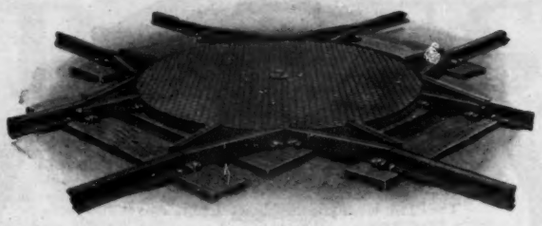

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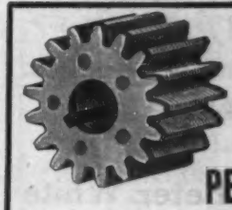

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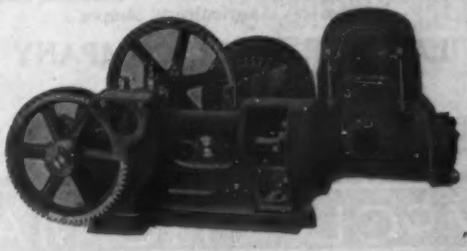

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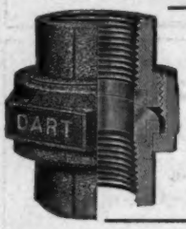

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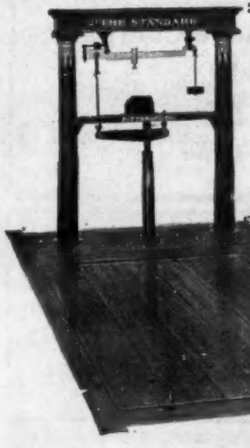

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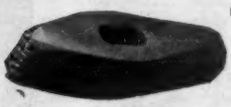

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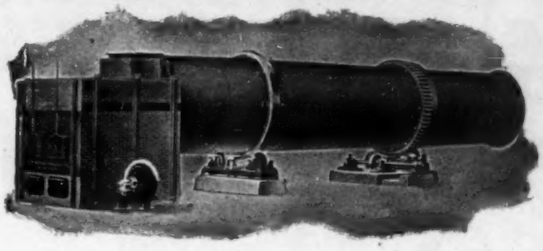

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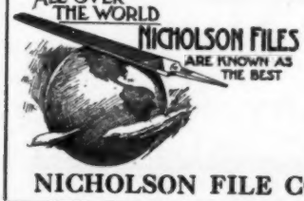

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Treating of Loam, Dry Sand, and Green Sand Molding, and Containing a Practical Treatise on the Management of Cupolas and the Melting of Iron. Nearly a hundred pages are devoted to the metallurgical side of foundry operations and cupola practice. Eleventh edition, revised, 408 pages, fully illustrated, cloth. Price, $2.50
PENTON'S BOOK NEWS 501 **Cleveland, Ohio**

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Manufacturers of High Grade Ground Fire Clay and Clay Fire Brick for Regenerator and Heating Furnaces, Boiler Settings and Arches, Stacks, Flues, By-Product, Rectangular and Bee Hive Coke Ovens.
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NEW JERSEY FIRE CLAY BRICKS
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WOODBRIDGE, N. J.
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UNDER SIGNED COUNSEL WILL CONfidentially negotiate preliminaries for important executive, technical, administrative and professional positions, insuring strictest privacy. Not an agency, but a highly-endorsed, high grade method of negotating preliminaries only, for $2,000 to $12,000 men. Send address only for explanation. R. W. Bixby, F1 Niagara Square, Buffalo, N. Y.

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THE BEST WAY TO GET A GOOD position in drafting or engineering is to file an application direct with some of our clients who are depending on us to get competent and experienced applicants for their vacant positions. Send stamp for blank and list of vacant positions. The Cleveland Engineering Agency Co., Rose building, Cleveland, O.

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ASSISTANT FOREMAN WANTED FOR steel foundry. Must be competent man on heavy work. State age, experience and salary expected. Give references. Mesta Machine Co., P. O. Box 1124, Pittsburgh, Pa.

WANTED: — FIRST-CLASS ROLLING Mill, Hammer Shop and Warehouse Foreman to have charge of all finishing operations. One having had experience in High-Speed and High Grade Tool Steels. Address Box 984, THE IRON TRADE REVIEW, Cleveland, O.

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EXPERIENCED FOREMAN FOR MALleable and Gray Iron Foundry, employing 125 men, equipped with Arcade machines and squeezers, small line of patterns used continuously. Applicant should be molder by trade, and capable as foreman totake charge of all malleable and gray iron foundry operations. Position permanent to right man. In reply, state age, education, experience, give reference and reason for making change. Do not reply unless you have successful record that will stand complete investigation. Reply at once. Address Box 983 The IRON TRADE REVIEW, Cleveland, O.

Positions Wanted

STEEL FOUNDRYMAN:—PRACTICAL and theoretical man, would negotiate for a responsible position in a converter steel foundry. References. Address Box 954, THE IRON TRADE REVIEW, Cleveland, O.

AS SUPERINTENDENT OR GENERAL Foreman of Malleable or Gray Iron Plant. Thoroughly experienced in modern shop management and production of every department; competent executive; technical training, age 38; A-1 references. Address Box 945, THE IRON TRADE REVIEW, Cleveland, O.

PURCHASING AGENT:—EIGHT YEARS experience in purchase of vairous steels and shop requirements of all kinds. Would consider position with high grade concern. Address Box 979 THE IRON TRADE REVIEW, Cleveland, O.

MASTER MECHANIC: FAMILIAR with construction and maintenance of general manufacturing work, both mechanical and electrical; 12 years experience. Best references, competent executive in handling men. Address Box 980 THE IRON TRADE REVIEW, Cleveland, O.

PURCHASING AGENT; AUDITOR OR Office Manager; highest grade automobile and general manufacturing experience. A-1 references. Hard worker. No booze. Moderate salary. Address Box 981 THE IRON TRADE REVIEW, Cleveland, O.

Positions Wanted

WHEN YOU NEED A HIGH GRADE executive, engineer, draftsman, or any technical man, consult The Engineering Agency, Inc., (Est. 24 years), 1662 Monadnock Block, Chicago.

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STEEL MAN

Wants manufacturing position, either as general superintendent or assistant to chief executive, now employed, but wants broader field; college graduate; 13 years experience operating and manufacturing; thoroughly efficient in production and practice, O. H. furnaces, blooming, bar, billet and sheet mills; competent executive in handling employes; age 39 (married), A-1 references. Address Box 956. THE IRON TRADE REVIEW, Cleveland, O.

SUPERINTENDENT OR MANAGER. Technical education; 20 years experience in both design and construction; cranes, hydraulic machinery, gas engines, rolling mill machinery, etc. Now engaged as superintendent. Address Box 967, THE IRON TRADE REVIEW, Cleveland, O.

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Can you use an accountant experienced in shop practice and factory costs; office manager and purchasing agent. During the last twenty-five years my experience has actually covered these positions and for the last ten years that of secretary and treasurer, employed at present but can furnish suitable reasons for making a change and satisfactory references. Address Box 965, THE IRON TRADE REVIEW, Cleveland, O.

AN ENGINEER WITH MANY YEARS experience as chief executive of one of the most widely known plants in the United States specializing in structural and plate work for steel plants, who has an intimate knowledge of the operations of every department, including purchasing, estimating, sales, manufacturing and financial, is desirous of making a new connection. At present engaged in an executive capacity, but can give excellent reasons for desiring change. Address Box 970, THE IRON TRADE REVIEW, Cleveland.

ROLLING MILL SUPERINTENDENT, 35 years of age; 17 years experience, at present employed; would like change. I can get results. Address Box 974, THE IRON TRADE REVIEW, Cleveland, O.

CHEMIST; AGE 29; 7 YEARS EXPErience in iron and steel analysis; technical graduate. Open for engagement. Address Box 958, THE IRON TRADE REVIEW, Cleveland, O.

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Agencies Wanted and Offered | **Investment of Capital** | **Plants for Sale Lease or Purchase**

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RAILS

Cars, Locomotives, Etc.
Steel Piling
Bought And Sold
ZELNICKER IN ST. LOUIS
Send For Our Bulletins

Manufacturing Business For Sale

Established over 30 years, a going concern, best possible reputation, 500 water H. P., 30,000 square feet floor space, no labor troubles. Catalog on request.

LANGDON C. FOSTER, Fulton, N. Y.

For Sale

Property 56 ft. wide by 350 ft. long with fine

Machine Shop

56 ft. front by 75 ft. long. Buildings contain 6048 sq. ft. floor space, two floors, with attic and cellar extra. Equipped with high grade Gas Engines, Lathes, Drilling Machines, Emery Grinders, Power Saws, Blacksmith Shop, High Grade Tools. Elevator in plant. Located on Hudson River, New York State, near all Railroads and Boat Landings. Exceptional Bargain. Write us for further particulars.

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A controlling interest in an old establishment and prosperous hardware and plumbing business in a Central New York town. Stock clean and new. A splendid opportunity for an experienced hardware man with about $25,000 capital. Good reasons for selling, will stand investigation.

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One Steel Mill Building

Frame 50 to 80 feet wide, 150 to 300 feet long, 25 to 35 feet clear height, preferably with crane way. Name best price and location.

Also electric crane 50 to 70 foot span, 15 to 35 tons capacity. Name price and location.

United States Electric Steel Co.
Pittsburg, Pa.

FOR SALE
IMMEDIATE DELIVERY
UNUSED MATERIAL

WIRE CABLE
1,000 ft. 1" Dia. 37-Strand Sweeds Iron.
LARGE BOLTS
1" Dia. 20" to 30" long.
1-1/4" Dia. 4" to 6-1/2" long.
1-1/4" Dia. 5-1/2" to 24" long.
STEEL BARS
Rounds—3/8" to 1-7/8" Dia.
Flats—3/8" to 2" x 2" to 6".
PLATES
3/8" to 1-1/2" x 7" to 36".
SPIKES
3-1/2"-4"-4-1/2" x 3/4"-11/16"-1/2".
NUT LOCKS
5/8" to 1-1/4".
JOINTS
160 Pairs Lorain 70-264.
250 Pairs Lorain 129-403.
RAILS
12 lb. to 45 lb. Tee.
FROGS AND SWITCHES
Dia. Turnouts 60 lb. and 70 lb.
Split Switches and Frogs.
Switch Stands.

CENTRAL TRACK SUPPLY CO.
Box 636
Springfield, Ohio

WANTED

A Cleveland selling agency of high standing, long experience and widely known can handle another account in the finished steel line.

We solicit correspondence with manufacturers who can use the services of such a sales organization.

Address Box 977
THE IRON TRADE REVIEW, Cleveland, O.

PROPOSALS FOR THE PURCHASE of Locomotives offered for sale by the Panama canal, and which are no longer needed.—Sealed proposals will be received at the office of the General Purchasing Officer, The Panama Canal, Washington, D. C.; until 10:30 a. m., Aug. 23, 1916, at which time they will be opened in public, for purchasing the above-mentioned locomotives. Blanks and general information relating to this Circular (No. 1057) may be obtained from this office or the offices of the Assistant Purchasing Agents, 24 State Street, New York City; 614 Whitney-Central building, New Orleans, La., and Fort Mason, San Francisco, Cal.; also from the U. S. Engineer Offices in the following cities: Seattle, Wash.; Los Angeles, Cal.; Baltimore, Md.; Philadelphia, Pa.; Pittsburgh, Pa.; Boston, Mass.; Buffalo, N. Y.; Cleveland, Ohio; Cincinnati, Ohio; Chicago, Ill.; St. Louis, Mo.; Detroit, Mich.; Milwaukee, Wis.; St. Paul, Minn.; Chattanooga, Tenn.; Louisville, Ky.; Mobile, Ala., and Galveston, Tex.; Commercial Club, Kansas City, Mo.; Chamber of Commerce, Quincy, Ill., and Commercial Club, Tacoma, Wash.—Earl I. Brown, major, Corps of Engineers, U. S. A., General Purchasing Officer.

FOR SALE
Controlling Interest

Consisting of 69% of the issued capital stock of an Incorporated Foundry & Machine Co., capitalized at $50,000 and earning 15% interest on this capital, besides paying a good salary to the active head of the business. This company is located in the greatest copper producing district of the Southwest, and will stand the most careful investigation, will sell above interest for $35,000.00.

Address Box 938
THE IRON TRADE REVIEW, Cleveland, O.

FOR SALE

220 ft. 24" No. 12 gauge galvanized spiral riveted pipe, with standard flanges attached—30" O. D., drilled 16-3/4" holes on a 27-3/4" bolt circle, together with the necessary bolts and gaskets for connecting. 2-24" galvanized cast iron elbows, 24" center to face, with flanged drilling to match the pipe.

This is absolutely new material and has never been used, purchased some five months ago; ready for immediate delivery. Address

Charcoal Iron Company of America
Marquette, Mich.

FOR SALE
Machine Shop & Foundry

In good town in western Michigan. Good opportunity for manufacturing business, ground area, 300' x 140'. Good reason for desiring to sell. Address

E. C. Rohn
Ludington, Mich.

For Sale

Drop Forge Plant in Racine, Wis.

Either entire or half interest.

Owner has other business. Would entrust management to well accredited practical forge superintendent or manager desiring to go into business for himself. Ten to fifteen thousand dollars required. Quick action, address

E. B. HAND
Badger Bldg. Racine, Wis.

Second Hand Machinery

Used Equipment of Metal-Working Plants

ADVERTISING RATES 1" One Time $2.50 2" One Time $4.75 3" One Time $6.75 4" One Time $8.25

RATES FOR LARGER SPACE OR LONGER PERIODS FURNISHED ON REQUEST

900 K. W. Gas Engines For Sale

Three Bethlehem Steel 26" x 32" twin tandem gas engines, direct connected to Crocker-Wheeler 250-volt shunt wound generators, 160 R. P. M. For use with producer or blast furnace gas. Repair parts, patterns for same, oiling system. Prompt shipment. May be seen in operation at Wyandotte, Mich. For further details write to

Pennsylvania Salt Mfg. Co.
Wyandotte Works
Wyandotte, Mich.

FOR SALE

One Heavy Duty Corliss Engine Manufactured by E. P. Allis Co., Milwaukee, Wis.

Bore of Cylinder	32"
Stroke	48"
Diameter of Main Shaft	15-7/8"
" " jack shaft	13-3/4"
" " fly wheel	24' 0"
" " driving gear	14' 5-1/2"
" " driven gear	9' 0"
" steam line	10"
" exhaust	12"

May be inspected at Cumberland, Md.

N. & G. TAYLOR COMPANY
No. 300 Chestnut St. Philadelphia, Pa.

FOR SALE

Two (2) Roll Lathes, one 30" swing with one set of housings and one 42" swing with two sets of housings, 18' 4" between centres. In first-class condition ready to run and can be shipped immediately.

Address Box 963
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WANTED

Brass melting furnaces and steel converters

State make, capacity and price.

J. S. McCORMICK CO., Pittsburgh, Pa.

IN STOCK:—An assortment of modern and rebuilt machine tools. Advise your requirements.

What have you to dispose of?

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BOUGHT, SOLD, RENTED EXCHANGED, REPAIRED

Biggest Stock in N. Y.
Over $50,000.00 worth ready for delivery

Nathan Klein & Company
208 CENTRE ST., N Y.
We Treat You Right—Ask Anybody

We Offer For Sale For Immediate Shipment

One 261 H. P. Stirling Water Tube Boiler and two Ingersoll Sergeant Steam driven air compressors. All have been used but are in good condition. For further particulars, address Purchasing Department

Harbison-Walker Refractories Company
Farmers Bank Bldg., Pittsburg, Pa.

For Sale Cheap

Six Return Tubular Boilers good for 95 pounds working pressure. Two of them 66 x 16 and four, 60 x 16.

Address P. O. Box 1015
Pittsburgh, Pa.

WANTED

Roll Lathe for turning 18 inch rolls. Send description, dimension, present location and price.

DUPLEX METALLIC COMPANY
Conshokocken, Pa.

FOR SALE

100 H. P. engine made by Ball Engine Company, Erie, Pa.
Open Frame—Center Crank
14" stroke—15" bore
Fly wheel 5 ft. 6 in. diameter
Right hand backward running.
Two (2) extra governor springs for same.

One (1) 5' Austin Separator

All in first class condition, at Cumberland, Md.

N. & G. TAYLOR COMPANY
300 Chestnut St. Philadelphia, Pa.

ASK US

for what you want; tell us what you have for sale. Perhaps we can sell you apparatus or trade you something you want for what you have that you cannot use.

EDGAR M. MOORE & CO
Pittsburg, Pa.

Wanted

One 1½" all steel bolt and rivet heading, upsetting and forging machine. Also 8 x 8 x ¾ all steel double angle shear. Both machines must be modern and in good condition. Write

Whitehead & Kales Co., Detroit, Mich.

Dry Pan Wanted

6' or 8' sand or loam grinder in first-class condition for mixing sand in steel foundry. Advise price and location for inspection.

INDUSTRIAL WORKS
Bay City, Mich.

Machinery for Immediate Delivery

1—38" x 14' 6" New Haven Engine Lathe, back geared, complete with compound rest for 2 tool holders, taper attachment.
1—Geo. Ohle Co's. Lathe 30" swing x 30' bed, triple geared, compound rest.
1—Garvin No. 4 Plain Milling Machine back geared.
Enterprise Lathe, 48 in. swing, 24 ft. bed, 18 ft. centers, single back geared, compound rest, power cross feed.
Nicholson & Waterman Horizontal Boring Mill, 54 in. swing, 7½ ft. between centers, screw and rod, power cross feed, back geared. Table 32 x 48.
Globe Iron Planer, 72 x 72 x 8 ft., one head.

Write for complete list

W. H. BOSWORTH
Commercial Bank Bldg., Cleveland, Ohio

OUTGROWN EQUIPMENT
offered through these columns constitute real industrial bargains.

YOUR REQUIREMENTS
can be met, at a great saving to you, by scanning these ads each week or inserting one yourself. 125

MUTUAL SATISFACTION ASSURED

Manufacturing Sites

Where to Locate and Why

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Cleveland, Ohio

Lake Shore R. R.
17 acres
1,000 ft. railroad frontage—400 ft. on paved street with car line—sewer, water, gas.

Nickel Plate R. R.
75 acres
1,600 ft. R. R. frontage—1,300 ft. on paved street with car line—sewer, water, gas.

Nickel Plate R. R.
6 acres
Streets on two sides—sewer, water.

Penna. R. R.
8 acres
Paved streets—sewer, water, gas.

Penna. R. R.
2 acres
Paved streets—water, sewer, gas.

Newburgh & S. Shore R. R.
6 acres
Paved streets—water, sewer, gas.

L. E. & P. R. R.
35 acres
Paved street—gas, water, sewer and near car line.

B. & O. R. R.
32 acres
Natural drainage—valley land.

All are within switching limits. Most of them will be sold entire or in part.

Located in various districts, they are convenient to various freight and express depots—and are near all classes of labor.

Prices are low, and in some cases lower than any similar properties. Terms of payment may be arranged.

Daniel R. Taylor
OR
Raymond T. Cragin
1006 Williamson Bldg.
Members Cleveland Real Estate Board

RIVER SITE FOR SALE

In Superior, Wis., (opposite Duluth) about 148 acres with frontage of 1700 ft. on St. Louis River. Several buildings in good order adapted for industrial purposes, Ship-building, Coal and Ore Docks, or Railroad Terminals. Excellent Rail Connections with all Railroads entering Superior.

Wm. B. Banks
First National Bank
Superior, Wis.

What They Say:

I want to express to you my sincere thanks for the very satisfactory way in which you handled the advertisement of the Industrial Corporation of Baltimore City, and I assure you when the time comes for additional advertising by this Corporation it will not be necessary for me to again recommend your valued publication, as it has given splendid and most satisfactory results.

L. JEFF MILBOURNE,
Advertising Agent

The foregoing is the epilogue of a successful advertising campaign covering a period of 8 weeks in the MANUFACTURING SITES section of THE IRON TRADE REVIEW.

Manufacturers, Real Estate Brokers, Chambers of Commerce, Boards of Trade and other industrial organizations interested in the location of industrial plants in their communities will find this department of great value and help.

What Does This MEAN to YOU?

Business prosperity should result in GREAT ACTIVITY on your part in spreading far and wide the advantages of Manufacturing Sites in your community.

The readers of THE IRON TRADE REVIEW are men of big affairs in the Iron, Steel, Foundry, Machinery and metal-working industries generally. They are men who are doing things—the men you want to interest.

Tell these men about the excellent facilities YOUR community has to offer—and tell your story in the

Manufacturing Sites Dept.
of
The Iron Trade Review
CLEVELAND

142

Manufacturing Sites

Where to Locate and Why

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RATES FOR LARGER SPACE OR LONGER PERIODS FURNISHED ON REQUEST

THE ELECTRIC Controller & Mfg. Company offers for sale an extremely desirable factory site. This was originally purchased for our own future needs; recently, however, we were able to buy property adjoining our present factories and therefore wish to dispose of the land.

The tract is in Cleveland, only four miles from the public square; it comprises 8-½ acres; it is almost exactly square; it is a corner lot with streets on two sides and the main line of the Pennsylvania R. R. on the third side; it is within short walking distance of four important street car lines; it is in an excellent labor district; it is substantially level; it is within the high pressure fire limits; it is near the Erie R. R. and the new Belt Line; and it is not far from the 105th station of the Rapid Transit Line in process of construction.

We will gladly furnish more detailed information to interested persons.

THE ELECTRIC CONTROLLER & MFG. CO.

CLEVELAND, OHIO

Manufacturing Site For Sale

26 acres within City limits, Buffalo, N. Y., on Niagara river and new U. S. Ship Canal.

Over 1500 feet water frontage: Concrete docks entire length. Best of rail and water facilities.

Many buildings on property suitable for manufacturing purposes.

Electric and Steam power plant capable of developing 2000 H. P.

Cheap electric power available. Unequaled distributing point.

Buffalo Smelting Works
No. 1 Austin Street, Buffalo, N. Y.

FOR SALE

River Frontage at Lorain, Ohio

Exceptionally placed for manufacturing sites. Over 2900 feet of river frontage, with an average depth of 3000 feet, a total of about 230 acres. Also a smaller tract of 44 acres with a river frontage of 750 feet. Good rail facilities available. These properties can be had at advantageous terms. Enquire,

THE GUARANTEE TITLE AND TRUST COMPANY
CLEVELAND, OHIO

Fill-in and Contract Work

Where orders may be secured for stampings, iron, steel or brass castings, dies, tank and boiler work, construction of special machines, building of patterns and models, experimental work, etc.; where special work may be secured for prompt delivery.

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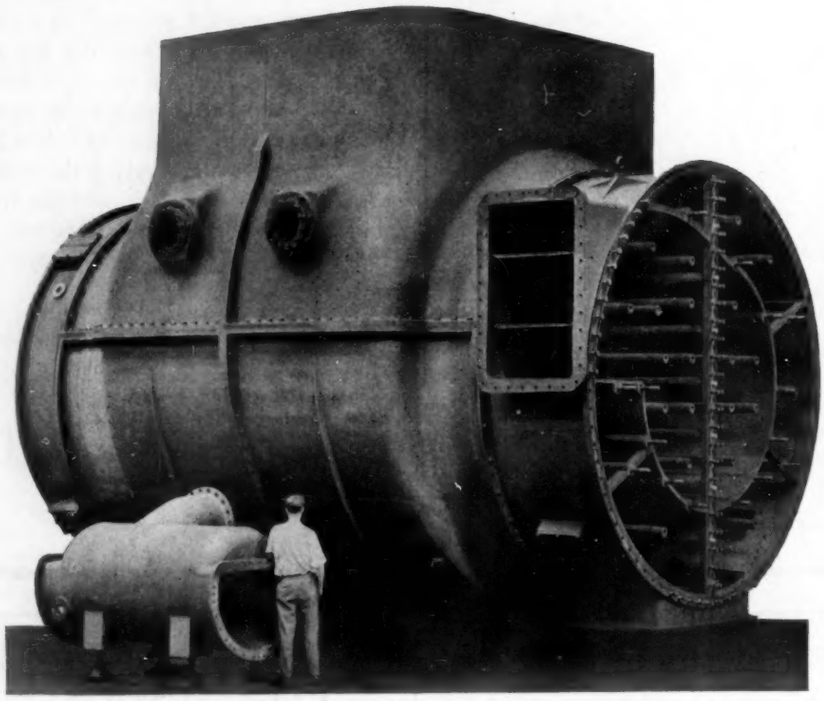
We Want to Place Large Contracts
With Several Foundries
For Gray Iron Castings



The tonnage is heavy and the shops that will figure on this work must have sufficient capacity to produce large condenser castings for early delivery.

If you have surplus capacity for immediate engagement and can handle this class of work, we want you to communicate with us immediately.

Write or wire Box 952

Care, THE IRON TRADE REVIEW, Cleveland, Ohio

Fill-in and Contract Work

Where orders may be secured for stampings, iron, steel or brass castings, dies, tank and boiler work, construction of special machines, building of patterns and models, experimental work, etc.; where special work may be secured for prompt delivery.

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RATES FOR LARGER SPACE OR LONGER PERIODS FURNISHED ON REQUEST

We Can Handle As a Fill-In
Some light machine and sheet metal work at reasonable prices.
Special machines for any purpose designed and built.
BROWNSTEIN MANUFACTURING CO.
Engineers and Manufacturers
Ellwood City, Pa.

We are looking for outside work for our
Machine, Pattern and Smith Shops
Brass and Gray Iron Foundry
Send Blue Prints for estimates.
Klotz Machine Co.
Sandusky, Ohio

Metal Stampings
DIES TOOLS JIGS
Let Us Estimate On Your Work
LANSING STAMPING & TOOL CO.
Dept. A LANSING, MICH.

MACHINE WORK WANTED

Our equipment consists of

two 16" and two 17" screw cutting lathes; one 22" turret lathe, one 48" lathe; one 36" drill; two planers, one 36" x 36" and one 24" x 24".

With this complete equipment and our broad experience we can handle practically any kind of machine work.

Can you use our facilities?

American Twist Drill Co.
Laconia, N. H.

Castings
Steel and Malleable Iron

Prompt Deliveries

Send Blue Prints or Samples.

We furnish high grade castings. Special quality, high tensile strength.

1 pound and upwards.

Murcott-Duden Co., Inc.
253 Broadway New York, N. Y.

Screw Machine Work
Brass Castings
Turret Lathe Work
Prompt deliveries—right prices
Send blue prints for quotations
Hill Pump Valve Company
Archer Ave., Canal & 23d Sts., Chicago, Ill.

CASTINGS
Gray Iron—Brass
PROMPT DELIVERIES
Also Pattern Making and Machine Work
THE
Scranton Pump Company
Scranton, Pa.

TOOLS — JIGS FIXTURES
G. H. SCOTT MACHINE CO.
118 Noble Court, Cleveland, O.

WANTED
Metal Stamping Work
Prompt and dependable deliveries. Send specifications for quotations.
THE METAL SPECIALTY CO.
6th and Burns St. CINCINNATI, OHIO

Screw Machine Products
Specialty of 1" to 2¾".
Acme Manufacturing Co.
Boonton, N. J.

Gears
Up to 64", Spur, Spiral or Worm
HIMOFF MACHINE CO.
126 Mott St. New York, N. Y.

SERVICE
That is what we can give you in our Pattern Department. Wood or Metal. Specialty Match Plates. Meta' Spinning. Send your blue prints to us first—We can save you money.
THE NEWARK STAMPING & FOUNDRY CO.
Plant No. 2 Newark, Ohio

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Abnormal Business Conditions—
What We Are Doing To Meet Them

Chapter F.

Doubling Our Cylinder Service To Solve Freight Congestion Problems

Abnormal business conditions have made freight congestion one of this country's biggest business handicaps.

And—authorities agree that there is no immediate possibility of relief through railway service expansion.

It is, therefore, clearly up to every manufacturer to devise his own ways and means of solving his own particular shipping troubles in these strenuous times.

With shipments of Oxygen cylinders, both full and empty, delayed days and even weeks, we decided that the only way to meet the situation in our own case, would be through tremendous expansion of our cylinder service.

To this end we have, for some time past, been putting new cylinders in commission at the rate of one a minute during every eight hour day.

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It is obvious that no one-plant concern could ever meet freight congestion or similar obstacles through any such super effort and sacrifice.

In Chapter "G" of this series, we will comment on the weakness of private plants as exposed by **Linde Service** under present day conditions.

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¶ Practically all E. C. & M. products are designed to eliminate labor or to replace skilled labor with unskilled labor.

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